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LEVEL II

6 INFANTRY AGENCY  
ARMY SMALL ARMS REQUIREMENTS  
STUDY I (ASARS I) (U) In Process Review

**UNITED STATES ARMY**  
**COMBAT DEVELOPMENTS COMMAND**  
IN-PROCESS REVIEW

Hum RRO  
DIVISION NO. 4  
AUG 4 1972  
FT. BENNING, GEORGIA

14 19 MARCH 1970

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A large, stylized handwritten signature in black ink, appearing to read "Alexander Nicolini".

ALEXANDER NICOLINI  
Major, Infantry  
R&D Coordinator

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**A**

ARMY SMALL ARMS REQUIREMENTS STUDY I (ASARS I)

IN-PROCESS REVIEW

19 MARCH 1970

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ARMY SMALL ARMS REQUIREMENTS STUDY I (ASARS I)

IN-PROCESS REVIEW

19 MARCH 1970

L I S T   O F   A T T E N D E E S

USACDCIA

COL Wear  
COL McDonald  
LTC Parker  
Mr. Follis  
Mr. Arendt (CARO)  
LTC Bushaw  
LTC O'NEIL  
LTC Ball  
LTC Turner  
MAJ Davis

USACDC

COL Gelling  
COL Rainville  
Mr. Haney

USACDCCAG

COL Tutwiler  
MAJ Murphy  
Mr. May  
Mr. Power (CARO)

USAMC

Mr. Cosgrove

USASASA

LTC James

HUMRRO

LTC Christie

ACSFOR

LTC Abood

USACDCISA

Dr. Bryson

USMC

LTC Michaels  
LTC Loehe  
MAJ Mullally

USAWECOM

Dr. Beckett  
Mr. Packard  
MAJ Huggin

USACDCEC

LTC Weinberg

USAIS

COL Fraser  
Mr. Himes  
Mr. Roberts

USAIB

Mr. Sudderth  
MAJ Philips

AMSAA

Mr. Simmons

C

FB <sup>C</sup> 10 MAY 63 208C

ASARS I  
IN-PROCESS REVIEW

19 March 1970

AT THE FIRST ASARS IPR, WHICH WAS HELD ON 17 DECEMBER 1969, MEMBERS OF THE ASARS STUDY TEAM GAVE YOU A LOOK INTO THE BACKGROUND OF ASARS AND PROVIDED YOU INFORMATION IN DETAIL AS TO HOW IT WAS PLANNED THAT THE OBJECTIVES OF THE STUDY BE MET. AFTER AN OPEN DISCUSSION, THE MEMBERS SEATED AROUND THIS TABLE CONCLUDED THAT THE STUDY WAS GENERALLY ON THE RIGHT TRACK, BUT MADE CERTAIN RECOMMENDATIONS FOR CHANGE AND MODIFICATIONS IN THE STUDY PLAN. THESE WILL BE POINTED OUT AS WE PROCEED TODAY.

AT THIS SECOND ASARS IPR, AS ASARS I NEARS COMPLETION, WE WILL SHOW AND TELL YOU WHAT HAS BEEN ACCOMPLISHED TO DATE AND WHAT IS TO BE ACCOMPLISHED DURING THE REMAINDER OF THE STUDY. MOST OF THE MATERIAL IS ABOUT READY TO BE PUT INTO FINAL FORM, AND YOU WILL BE ABLE TO JUDGE, IN MOST CASES, WHETHER OR NOT THE OBJECTIVES HAVE BEEN MET SUFFICIENTLY WELL TO CONTINUE INTO ASARS II. WE FEEL THAT WE HAVE SUFFICIENT DATA WITH WHICH TO START ASARS II, AND ARE READY TO CONTINUE INTO THAT PHASE.

BEFORE WE GO INTO THE DETAILED REPORT OF THE ACCOMPLISHMENTS TO DATE, I BELIEVE IT WOULD BE BEST, BOTH FOR THE BENEFIT OF SOME NEWCOMERS TO ASARS AS WELL AS A REFRESHER TO THOSE OF YOU WHO HAVE NOT COME INTO CONTACT WITH THE STUDY SINCE LAST DECEMBER, TO AGAIN GIVE YOU A SKETCH OF WHERE ASARS FITS INTO THE OVERALL SMALL ARMS PROGRAM. WE WILL ALSO BRIEFLY COVER THE OBJECTIVES OF ASARS I AND ASARS II DURING THIS REFRESHER

PERIOD IN ORDER TO PROVIDE BETTER UNDERSTANDING OF THE HOW AND WHY OF ASARS I. THIS GENERAL ORIENTATION PERIOD WILL BE FOLLOWED BY A DETAILED DESCRIPTION OF THE ACCOMPLISHMENTS OF ASARS I TO DATE. AS IN THE LAST IPR, THE PRESENTATIONS WILL BE FOLLOWED BY A DISCUSSION PERIOD, WHEN QUESTIONS THAT HAVE ARISEN MAY BE CLEARED UP. I WOULD LIKE TO REMIND YOU AT THIS TIME THAT COPIES OF ALL SLIDES USED ARE IN THE HAND-OUTS. THERE ARE ALSO PAGES PROVIDED FOR THE PURPOSE OF MAKING ANY NOTES YOU MAY WISH TO RETAIN.

LET'S TURN FIRST TO JUST HOW ASARS CAME INTO BEING. THE OFFICE OF THE ASSISTANT CHIEF OF STAFF FOR FORCE DEVELOPMENT AT DEPARTMENT OF THE ARMY PUBLISHED, IN EARLY 1968, A DOCUMENT ENTITLED THE ARMY SMALL ARMS PROGRAM - MORE COMMONLY REFERRED TO AS THE ARSAP. THE PURPOSE OF THIS PROGRAM IS TO INSURE THAT THE UNITED STATES ARMY HAS THE MOST COMBAT EFFECTIVE SMALL ARMS SYSTEM AVAILABLE. THERE WERE MANY TASKS DELEGATED BY THE ARSAP, SOME TO CONARC, SOME TO AMC AND OTHERS TO CDC. AMONG THE TASKS ASSIGNED THE COMBAT DEVELOPMENTS COMMAND WAS THAT OF CONDUCTING STUDIES TO COLLECT AND ANALYZE DATA PERTAINING TO SMALL ARMS AND THEIR EMPLOYMENT FOR THE 1980-1985 TIME PERIOD - OR LONG-RANGE, AS DEFINED IN THE ARSAP. FROM THESE EFFORTS WOULD BE DEVELOPED A LIST OF VARIABLE CHARACTERISTICS - PERFORMANCE AND PHYSICAL - THAT ARE DESIRED IN A FAMILY OF SMALL ARMS, ALONG WITH A MEANS OF DETERMINING THE RELATIVE IMPORTANCE AMONG THEM IN VARYING SITUATIONS. THIS REQUIREMENT WAS CONTAINED IN THE OBJECTIVES OF TWO ARSAP TASKS, TASK VIII-C-5-a, ASARS I, AND VIII-C-5-c, OR ASARS II. THESE TWO TASKS CONTAIN THE OVERALL OBJECTIVE SHOWN ON THIS SLIDE.

(SLIDE 1 ON)

PLEASE NOTE TWO THINGS AT THIS TIME. FIRST, ASARS IS NOT TO PRODUCE HARDWARE, BUT WILL PROVIDE A LIST OF CHARACTERISTICS THAT CAN BE USED IN THE DEVELOPMENT OF MATERIEL REQUIREMENTS DOCUMENTS. SECONDLY, THAT ASARS, IN CONJUNCTION WITH OTHER ARSAP STUDIES AND TASKS, WILL PERMIT DEVELOPMENT OF A SMALL ARMS SYSTEM FOR THE 1980-1985 TIME PERIOD. IN OTHER WORDS, ASARS ALONE WILL NOT SOLVE ALL THE PROBLEMS AND ANSWER ALL THE QUESTIONS NECESSARY FOR THE DEVELOPMENT OF A SMALL ARMS SYSTEM. IT SHOULD, HOWEVER, PROVIDE A NUMBER OF THE ANSWERS.

(SLIDE 1 OFF)

FOR YOUR INFORMATION, HERE ARE EXAMPLES OF SOME ARSAP TASKS THAT SHOULD PROVIDE INPUT FOR FUTURE STUDIES AND FOR MATERIEL REQUIREMENT DOCUMENTS:

(SLIDE 2 ON)

WE HAD HOPED TO HAVE INPUT FOR ASARS FROM THE TWO TASKS SHOWN UNDER THE MID-TERM EFFORTS, BUT AS YET THEY HAVE NOT BEEN FORTHCOMING, SO WE HAVE ATTEMPTED TO DEVELOP THE NECESSARY DATA IN A HUMAN FACTORS STUDY. THE RESULTS WILL BE DISCUSSED BY LTC BUSHAW.

(SLIDE 2 OFF)

AS STATED EARLIER, CDC WAS TASKED BY THE ARSAP TO COLLECT AND ANALYZE DATA PERTAINING TO SMALL ARMS. ASARS I IS THE DATA COLLECTION PHASE OF THIS EFFORT. THE PRESCRIBED OBJECTIVE OF ASARS I IS SHOWN HERE:

(SLIDE 3 ON)

A CRUCIAL PART OF THE CONDUCT OF THIS AND FUTURE STUDIES UNDER THE ARSAP IS THE ESTABLISHMENT OF A DATA BANK AND A BROAD DATA BASE. PAST STUDIES

HAVE SUFFERED BECAUSE OF VOIDS AND GAPS IN DATA, AND THIS IS TO ASSIST IN ALLEVIATING THAT DEFICIENCY. UNFORTUNATELY, THERE ARE STILL GAPS EXISTING THAT WE HAVE BEEN UNABLE TO FILL, AS WE WILL EXPLAIN WHEN WE GO INTO THE DETAILS OF ASARS I.

(SLIDE 3 OFF)

WITHIN ASARS I, WE HAVE DEVELOPED CERTAIN TASKS THAT MUST BE ACCOMPLISHED TO MEET THE REQUIREMENTS FOR DATA COLLECTION. HOWEVER, TO PROVIDE AN UNDERSTANDING OF THE REASONS FOR THESE VARIOUS TASKS, I WILL FIRST SHOW YOU THE OBJECTIVE OF ASARS II:

(SLIDE 4 ON)

THIS IS THE ANALYSIS PHASE OF THE ASARS STUDY, AND IT WILL BE ACCOMPLISHED PRIMARILY THROUGH COMPUTER SIMULATION, WITH AN ANALYSIS OF THE SIMULATION RESULTS TO OBTAIN THE LIST OF VARIABLE CHARACTERISTICS WE SPOKE OF EARLIER.

I SHOULD POINT OUT HERE THAT THIS OBJECTIVE, AS WRITTEN, MIGHT BE MISLEADING IN THAT IT LEADS TO OVERLY BROAD INTERPRETATION. IT HAS BEEN INTERPRETED IN VARIOUS WAYS HERE AT THE AGENCY AS PERSONNEL CHANGES OCCURRED.

(SLIDE 4 OFF)

WE, IN THE LAST IPR, THROUGH THIS SLIDE AND OUR EXPLANATION OF SUBTASK 6 OF ASARS II, WHICH YOU SEE ON THIS NEXT SLIDE

(SLIDE 5 ON)

ADDED TO THE MISCONCEPTIONS. SOMEONE AT THE LAST IPR STATED THAT THEY FELT THAT THE STUDY HAD BECOME TOO BROAD, AND I HAVE COME TO REALIZE WHAT WAS MEANT. THE OBJECTIVE OF ASARS II AND SUBTASK 6 OF ASARS II, AS WRITTEN, CAN BE

INTERPRETED TO MEAN THAT A LIST OF ALL OF THE CHARACTERISTICS REQUIRED IN A SMALL ARMS SYSTEM WILL BE PROVIDED BY ASARS. THIS IS NOT PLANNED IN OUR PROPOSED METHODOLOGY. ASARS II IS PRESENTLY DESIGNED TO DEVELOP THE LIST OF VARIABLE CHARACTERISTICS AND TRADE-OFF CAPABILITIES AMONG THESE CHARACTERISTICS AND USE THESE IN PREPARATION OF THE MISSION AND PERFORMANCE ENVELOPES. THE OTHER CHARACTERISTICS - THE FIXED ONES, SUCH AS CONFIGURATION, RELIABILITY, AND MAINTAINABILITY SHOULD COME FROM OTHER STUDIES AND TESTS. ASARS II WILL PROBABLY, THROUGH FALL-OUT FROM THE SIMULATIONS, AND FROM SOME OF THE ANNEXES TO THE STUDY, SUCH AS THE DOCTRINAL REQUIREMENTS AND ROLE OF THE SMALL ARMS, PROVIDE INPUT TO OTHER PARTS OF THE REQUIREMENTS DOCUMENTS, AND TO OTHER STUDIES. WE PLAN TO SUBMIT CHANGES TO CLARIFY THESE OBJECTIVES.

(SLIDE 5 OFF)

LET'S LOOK AT THE TASKS THAT HAVE BEEN DEVELOPED IN ASARS I TO PROVIDE THE NECESSARY DATA FOR THE COMPLETION OF ASARS II:

(SLIDE 6 ON)

THE STATUS OF EACH OF THESE TASKS WILL BE DISCUSSED DURING THE DETAILED COVERAGE OF ASARS I BY LTC BUSHAW AND MAJ DAVIS. THOSE TASKS INDICATED AS CARO TASKS ARE BEING - OR HAVE BEEN DONE BY THE COMBINED ARMS RESEARCH OFFICE OF BOOZ-ALLEN APPLIED RESEARCH, INC., WHICH IS THE CONTRACTOR FOR THE STUDY AND HAS DONE MOST OF THE SCIENTIFIC WORK.

(SLIDE 6 OFF)

ADDITIONAL TASKS BEING UNDERTAKEN IN ASARS I ARE SHOWN HERE:

(SLIDE 7 ON)

CONCERNING THE LAST ITEM ON THIS SLIDE. THE SIMULATION MODEL TO BE USED IS ONE OF OUR CURRENT PROBLEMS. IT HAS BEEN DETERMINED THAT IF AT ALL POSSIBLE, THE OPMOR (OPERATIONS, MATERIEL, AND ORGANIZATION) MODEL, WHICH IS A MODIFICATION OF THE OHIO STATE DYTACS MODEL, SHOULD BE USED FOR THE SIMULATIONS TO BE CONDUCTED IN ASARS II. A CONTRACT HAS NOT AS YET BEEN LET FOR THE PREPARATION OF AN INFANTRY MODULE FOR OPMOR, AND IT IS DOUBTFUL IF THAT CONTRACT CAN BE LET NOW IN TIME FOR THE MODEL TO BE READY TO COMMENCE AS THE SCHEDULE PRESENTLY PROVIDES. HOPEFULLY, THE MODEL WILL BE SO GOOD THAT IT WILL ENABLE US TO FINISH ON SCHEDULE EVEN THOUGH WE MAY START LATE. THIS COULD VERY WELL BE WISHFUL THINKING.

(SLIDE 7 OFF)

THE ANSWERS - OR RESULTS - OF THE TASKS WITHIN ASARS I ARE TO BE INCLUDED IN THESE ANNEXES TO THE ASARS I REPORT:

(SLIDE 8 ON)

DRAFTS OF MOST OF THESE ANNEXES ARE HERE WITH THE BRIEFERS WHO WILL PRESENT THE MATERIAL. YOU ARE FREE TO EXAMINE THEM, BUT PLEASE DO NOT REMOVE THEM AS THEY ARE NOT AS YET READY FOR RELEASE.

(SLIDE 8 OFF)

IF YOU WILL OPEN YOUR HAND-OUTS TO PAGE 1 AT TAB G, YOU WILL FIND A FOLD-OUT THAT WILL SHOW YOU HOW THE INFORMATION CONTAINED IN THE VARIOUS ANNEXES WILL FEED INTO ASARS II. YOU MAY FIND THIS FOLD-OUT HANDY AS WE PROCEED THROUGH THE DETAILED PORTIONS OF THIS IPR. THE SECOND PAGE AT TAB G SHOWS THE MAJORITY OF THE INFORMATION REQUIRED BY MATERIEL REQUIREMENT DOCUMENTS WITH AREAS RECEIVING INPUT FROM ASARS II INDICATED BY THE ASTERISKS.

INPUT FOR OTHER STUDIES AND INFORMATION TO ASSIST IN THE DEVELOPMENT OF REQUIREMENT DOCUMENTS MAY FALL OUT OF THE ASARS SIMULATIONS, AND MAY IN SOME CASES BE AVAILABLE FROM SUCH DOCUMENTS AS THE DOCTRINAL REQUIREMENTS ANNEX, BUT ASARS IS AIMED PRIMARILY AT PROVIDING THOSE VARIABLE CHARACTERISTICS THAT ACT UPON EACH OTHER, ALONG WITH A MEANS OF DETERMINING TRADE-OFFS BETWEEN THEM.

THE SLIDE YOU SEE HERE

(SLIDE 9 ON)

GIVES YOU AN INDICATION OF WHERE SOME OF THE INPUT FOR A REQUIREMENT DOCUMENT FOR THE 1985 TIME FRAME MIGHT COME FROM.

(SLIDE 9 OFF)

AS FURTHER BACKGROUND FOR THOSE OF YOU WHO ARE NEW TO ASARS, I WILL SHOW YOU THE DEFINITION OF A SMALL ARMS SYSTEM THAT IS BEING USED IN THE ASARS STUDIES.

(SLIDE 10 ON)

ALTHOUGH NOT SPECIFICALLY STATED, THIS INCLUDES GRENADE LAUNCHERS. IT DOES NOT INCLUDE SUCH WEAPONS AS SNIPER RIFLES, ON WHICH A STUDY WAS RECENTLY MADE, OR SILENT KILL WEAPONS.

(SLIDE 10 OFF)

THE SCOPE, OR GEOGRAPHIC AREAS THE STUDY PLAN PRESENTLY INCLUDES FOR SIMULATED COMBAT IN ASARS II ARE SHOWN ON THIS SLIDE.

(SLIDE 11 ON)

WE ARE PLANNING TO RECOMMEND A REDUCTION IN THIS SCOPE, PRIMARILY DUE TO LIMITATIONS IMPOSED BY THE MODEL. ONE OF THESE LIMITATIONS IS THAT THE MODEL WILL PLAY ONLY MID INTENSITY CONFLICT. THE OTHER IS THAT

IT WILL PROBABLY ENABLE THE PLAY OF A FORCE NO LARGER THAN A PLATOON, WITH THE POSSIBILITY OF GOING UP TO A COMPANY. ALTHOUGH WE HAD ORIGINALLY PLANNED TO PLAY A BATTALION IN THE SIMULATIONS, A REALISTIC APPRAISAL, WITH THE MODEL LIMITATIONS IN MIND, CAUSES US TO BELIEVE THAT WE CAN REDUCE THE SCOPE AND STILL ACCOMPLISH THE OBJECTIVES OF ASARS. THE SCOPE WE ARE RECOMMENDING TODAY IS SHOWN HERE.

(FLIP ON)

(SLIDE 11 OFF)

THE THREAT FORCES WE WILL PLAY ARE AS PRESCRIBED IN THREAT DOCUMENTS APPROVED BY HIGHER HEADQUARTERS. FOR THE FRIENDLY FORCES WE INTEND TO USE THE INFANTRY-75 ORGANIZATION, UTILIZING MAINLY THE IRUS PLATOON. THAT UNIT IS SHOWN ON THIS NEXT SLIDE.

(SLIDE 12 ON)

DPW IS A DUAL PURPOSE WEAPON. AS STATED A FEW MINUTES AGO, IT IS NOW A DISTINCT POSSIBILITY THAT THE PLATOON WILL BE THE LARGEST FORCE WE CAN SIMULATE IN THE MODEL TO BE USED. HOWEVER, IT IS FELT THAT THE STUDY OBJECTIVES CAN STILL BE MET WITH LIMITATIONS IMPOSED.

(SLIDE 12 OFF)

THIS GIVES YOU A BACKGROUND FROM WHICH WE WILL NOW LAUNCH INTO THE DETAILS OF THE ASARS I TASKS. I WILL BE FOLLOWED BY COLONEL BUSHAW.

D

FB<sup>C</sup><sub>10</sub> MAY 63 208

DURING MY PORTION OF THE BRIEFING I WILL DISCUSS ANNEXES B THROUGH J.  
OF THESE ANNEXES, B, C, D, AND H WILL REQUIRE APPROVAL OF HIGHER HEADQUARTERS  
PRIOR TO THE BEGINNING OF ASARS II.

THE THREAT, OR ANNEX B, OF THE ASARS REPORT WAS PREPARED BY THE CONTRACTOR  
AND ESTABLISHES THE SETTING AND PHYSICAL CONDITIONS FOR THE USE OF THE  
WEAPONS SYSTEM AND THE EXPECTED CHARACTERISTIC DOCTRINE AND CAPABILITIES OF  
THE ENEMY FORCES WE ARE CONCERNED WITH IN ASARS. \* \* \* \* \*

\* \* \* \* \* AS INDICATED  
ON THE FOLD-OUT, ANNEX B CONTRIBUTES TO THE DEVELOPMENT OF SCENARIOS AND  
THE TARGET DISTRIBUTION, ANNEX C. A COPY OF THE DRAFT THREAT WAS FORWARDED  
TO HQ USACDC IN SEPTEMBER FOR INFORMAL COMMENT. COMMENTS AND A COPY OF  
THREAT FOR ARMY-85 WERE BOTH RECEIVED BY THE STUDY GROUP IN DECEMBER, JUST  
PRIOR TO THE PREVIOUS ASARS I IPR. UPON RECEIPT OF THESE DOCUMENTS WORK ON  
REVISING THE DRAFT THREAT TO ENSURE CONFORMITY WAS INITIATED. THE REVISED  
EDITION OF THE THREAT WILL BE FORWARDED THRU CHANNELS THIS MONTH FOR APPROVAL.

TO APPLY THE INFORMATION CONTAINED IN THE THREAT, IT IS NECESSARY TO HAVE A  
PICTURE OF HOW THE GENERAL FACTORS OF THE THREAT FORCE COMBINE TO PRODUCE  
THE ENEMY DISPOSITION IN A SPECIFIC SITUATION. THIS REQUIREMENT IS ADDRESSED  
IN THE TARGET DISTRIBUTION ANNEX OR ANNEX C WHICH CONTRIBUTES DIRECTLY TO THE  
DEVELOPMENT OF THE SCENARIOS TO BE USED FOR SIMULATION.

DEVELOPMENT OF THIS ANNEX IS AN ASARS I TASK AS SHOWN ON THIS SLIDE.

(SLIDE 13 ON)

(SLIDE 13 OFF)

THE ANNEX IS IN THE FINAL STAGES OF COMPLETION BY THE CONTRACTOR.

TEN TARGET ARRAYS HAVE BEEN DEVELOPED COVERING THE TACTICAL SITUATIONS, AND GEOGRAPHICAL AREAS SHOWN HERE. THEY WILL BE FORWARDED THROUGH CHANNELS FOR APPROVAL.

(SLIDE 14 ON)

(SLIDE 14 OFF)

AS WAS POINTED OUT BY COL PARKER AND FOR THE REASONS HE STATED ALL OF THE SITUATIONS DEPICTED ON THE SLIDE MAY NOT BE UTILIZED IN THE SIMULATION. THE SITUATIONS DEVELOPED FOR LOW AND HIGH INTENSITY HOWEVER, WITH SLIGHT MODIFICATION CAN BE UTILIZED FOR MID INTENSITY.

IN ASARS THE "LEVEL OF RESOLUTION" OR THE SMALLEST, INTEGRAL UNIT OR ELEMENT DEPICTED ON THE ARRAY IS THE RIFLE SQUAD AND EACH INDIVIDUAL CREW-SERVED WEAPON AND COMBAT VEHICLE. THE LARGEST FORCE PORTRAYED IS A REINFORCED BATTALION, ALTHOUGH NO HIGHER THAN PLATOON LEVEL ORGANIZATION MAY BE PLAYED.

FOUR ASPECTS OF THE TARGET ARE SPECIFICALLY MENTIONED IN THE ASARS TASK: THESE ARE THE TARGET RANGE, TYPE, ACTIVITY AND EXPOSURE TIME. DETERMINATION OF TARGET RANGE, TYPE AND ACTIVITY POSE NO PROBLEM.

HOWEVER, AS POINTED OUT IN THE PREVIOUS IPR, THE DETERMINATION OF EXACT TARGET EXPOSURE TIME WAS A PROBLEM. THIS CONTINUES TO REMAIN A PROBLEM AND THE METHOD THAT WILL BE USED IN DETERMINING EXPOSURE TIME HAS NOT AS YET BEEN RESOLVED AND WILL NOT BE UNTIL MORE INFORMATION REGARDING THE MODEL IS AVAILABLE. SUFFICE TO SAY IT WILL BE BASED PRIMARILY ON MILITARY JUDGMENT.

ANNEX D, ROLE OF THE SMALL ARMS, ADDRESSES THE ASARS I TASK SHOWN HERE:

(SLIDE 15 ON)

(SLIDE 15 OFF)

THIS ANNEX DISCUSSES THE FUNCTION OR ROLE OF THE SMALL ARMS SYSTEM DURING COMBAT AND CONTRIBUTES TO SCENARIO DEVELOPMENT. IT WAS DEVELOPED IN COORDINATION WITH THE INFANTRY SCHOOL, AND IS NOW BEING PLACED IN FINAL FORM. IT IS ONE OF THE ANNEXES THAT WILL REQUIRE THE APPROVAL OF HIGHER HEADQUARTERS PRIOR TO THE BEGINNING OF ASARS II. THE ROLE OF THE SMALL ARMS AS DEFINED BY THE ASARS STUDY GROUP IS SHOWN ON THIS SLIDE.

(SLIDE 16 ON)

(SLIDE 16 OFF)

IN DETERMINING SMALL ARMS REQUIREMENTS AND THE OVERALL EFFECTIVENESS OF SMALL ARMS, CONSIDERATION MUST BE GIVEN TO THE INDIVIDUAL SOLDIER AND THE HUMAN FACTORS THAT ENTER INTO THE EMPLOYMENT OF SMALL ARMS. THE HUMAN FACTORS TASK OF ASARS I IS SHOWN ON THIS SLIDE.

(SLIDE 17 ON)

THIS ANNEX IS BEING DEVELOPED BY THE CONTRACTOR AND IS NOW IN THE REWRITE STAGE. IT SHOULD BE COMPLETED BY MID-APRIL. DATA FROM THE ANNEX WILL BE USED IN THE COMPUTER SIMULATION.

(SLIDE 17 OFF)

THE SOLUTION TO THIS REQUIREMENT WAS INTENDED TO FILL ONE OF THE DATA GAPS CURRENTLY EXISTING IN THE ARMY SMALL ARMS PROGRAM. IT WAS HOPED BY THE ASARS STUDY GROUP THAT DATA FROM ARSAP TASK VIII-B-5-e, WHICH ADDRESSES SUPPRESSION AND FROM TASK VIII-B-5-b WHICH IS CONCERNED WITH TARGET ACQUISITION WOULD BE AVAILABLE FOR USE IN MEETING THIS REQUIREMENT. HOWEVER, THIS IS NOT THE CASE AND SINCE NO NEW DATA IN THESE AREAS HAVE BEEN DEVELOPED BY ASARS, THESE GAPS STILL EXIST. IN ORDER TO PROVIDE AN INPUT ON SUPPRESSION WE INTEND TO USE THE CDCEC DEVELOPED DEFINITION OF A SUPPRESSION THRESHOLD, WHICH IS THE ONLY ONE CURRENTLY AVAILABLE ALONG WITH CDCEC'S DESCRIPTION OF SUPPRESSION DURATION.

AS FOR TARGET ACQUISITION, IT IS UNDERSTOOD THAT RAC HAS DEVELOPED A TARGET ACQUISITION MODEL WHICH WILL SATISFY THE TARGET ACQUISITION REQUIREMENTS IN ASARS. IT IS FURTHER UNDERSTOOD THAT DR. WALTER LAWSON, NIGHT VISION LABORATORIES, ELECTRONICS COMMAND, WILL HAVE AN IMPROVED VERSION AVAILABLE ON 1 MAY OF THIS YEAR THAT WILL ALLOW THE PLAY OF OPTICS AS WELL AS THE NAKED EYE.

ANNEX F, INFANTRY BATTALION TARGET ACQUISITION CAPABILITIES ADDRESSES THE USE OF STANO EQUIPMENT. IT WAS DESIGNED TO FILL A DATA GAP AND INPUTS INTO THE REQUIREMENT DATA CATEGORY OF THE REQUIRED SIMULATION INPUT AND WILL BE CONSIDERED IN THE DEVELOPMENT OF SCENARIOS. THE ANNEX IS IN RESPONSE TO THE ASARS TASK SHOWN ON THIS SLIDE.

(SLIDE 18 ON)

IT IS CURRENTLY IN COORDINATION DRAFT FORM.

(SLIDE 18 OFF)

THE ANNEX CONTAINS A LISTING OF THE STANO EQUIPMENT PRESENTLY IN THE INVENTORY, UNDER DEVELOPMENT, OR AS DESCRIBED IN A QMR.

THE LISTING INCLUDES EQUIPMENT IDENTIFICATION, LIKELY EMPLOYMENT AND BASIS OF ISSUE AND GENERAL CAPABILITIES. FOR THE PURPOSE OF ASARS, ONLY THOSE DEVICES WHICH WOULD HABITUALLY BE EMPLOYED BY OR IN DIRECT SUPPORT OF THE INFANTRY BATTALION ARE CONSIDERED. STANO EQUIPMENT WILL INFLUENCE SMALL ARMS EMPLOYMENT IN THAT THEY WILL ENABLE THE SMALL ARMS USER TO MORE READILY ACQUIRE AND ENGAGE TARGETS, ESPECIALLY AT NIGHT. STANO DEVICES WILL ALSO ENHANCE THE EMPLOYMENT OF SUPPORTING WEAPONS AND AS SUCH MAY HAVE AN INDIRECT INFLUENCE ON SMALL ARMS REQUIREMENTS.

THE ACTUAL DECISION OF HOW THESE DEVICES ARE TO BE EMPLOYED WITHIN SIMULATION WILL DEPEND ON THE MODEL USED, FORCES TO BE SIMULATED AND THE DEGREE OF EMPHASIS TO BE PLACED ON STANO AND WHETHER NIGHT OPERATIONS WILL BE PLAYED.

THE TARGET ACQUISITION MODELS MENTIONED EARLIER: THE ONE BY RAC AND THE IMPROVED VERSION BY DR. LAWSON, WHICH PLAYS OPTICS AS WELL AS THE NAKED EYE SHOULD PERMIT USE OF THESE DEVICES IN SIMULATION.

ANNEX G OF ASARS I REPORT IS TITLED CASUALTY DATA AND IS IN RESPONSE TO THE ASARS TASK SHOWN HERE.

(SLIDE 19 ON)

THIS WAS A DATA COLLECTION EFFORT AND IS COMPLETED. INFORMATION IN THE ANNEX AS INDICATED ON THE FOLD-OUT, WILL SERVE AS A CHECK IN DETERMINING REALISM OF OUTPUT FROM COMPUTER SIMULATION.

(SLIDE 19 OFF)

MOST OF THE DATA IN THE ANNEX ADDRESSES FRIENDLY CASUALTIES AS VERY LITTLE INFORMATION REGARDING ENEMY CASUALTIES IS AVAILABLE. ONE POSSIBLE SOURCE OF THIS TYPE DATA NOT YET DEVELOPED IS FROM THE GERMANS IN THAT AFTER A BRIEFING ON ASARS DURING FEBRUARY AT A SPECIAL MEETING OF NATO WEAPONS PANEL III, DELEGATES OF NATO COUNTRIES EXPRESSED AN INTEREST IN THE STUDY AND DESIRED TO KNOW WHAT THEY COULD CONTRIBUTE. CASUALTY DATA FROM THE GERMANS FOR WORLD WAR II, IF AVAILABLE, COULD BE ONE POSSIBLE CONTRIBUTION.

DISCUSSION WITHIN ANNEX G IS DIVIDED INTO FOUR GENERAL SECTIONS:

1. INCIDENCE OF CASUALTIES
2. CASUALTIES BY CAUSATIVE AGENTS
3. ANATOMIC DISTRIBUTION OF WOUNDS
4. CIRCUMSTANCES OF CASUALTY PRODUCTION

ANNEX H OF THE ASARS I REPORT RECOGNIZES THE ASARS REQUIREMENT SHOWN ON THIS SLIDE.

(SLIDE 20 ON)

THE ANNEX IS BEING PLACED IN FINAL FORM AND WILL REQUIRE APPROVAL OF HIGHER HEADQUARTERS PRIOR TO THE INIATION OF ASARS II - AS INDICATED ON YOUR FOLD-OUT IT CONTRIBUTES TO THE DEVELOPMENT OF SCENARIOS.

(SLIDE 20 OFF)

IN ESTABLISHING THE DOCTRINAL REQUIREMENTS FOR SMALL ARMS, THE STUDY GROUP LEANED HEAVILY ON ARMY CONCEPT STUDY-85, INFANTRY-75 AND THE THREAT FOR ARMY-85, AND RELATED STUDIES AND REPORTS. IT WAS RECOGNIZED THAT ASARS BY DIRECTION OF THE ARSAP IS TO BE CONCERNED WITH SMALL ARMS FOR THE ENTIRE ARMY. HOWEVER, SINCE INFANTRY IS THE PRIME USER OF SMALL ARMS FOR COMBAT MISSION ACCOMPLISHMENT IT IS IMPERATIVE FROM A DOCTRINAL VIEWPOINT THAT INFANTRY REQUIREMENTS FOR SMALL ARMS BE SATISFIED.

IT IS VISUALIZED THAT THE BASIC OPERATIONAL AND ORGANIZATIONAL CONCEPTS ADDRESSED IN INFANTRY-75 WILL REMAIN VALID THROUGH THE 1980-1985 TIME PERIOD. ANY CHANGES WILL BE EVOLUTIONARY AS OPPOSED TO REVOLUTIONARY. NEW EQUIPMENT AND IMPROVED COMMUNICATION, INTELLIGENCE AND FIRE SUPPORT SYSTEMS WILL RESULT IN CHANGES TO OPERATIONAL TECHNIQUES, HOWEVER, THE BASIC CONCEPTS WILL NOT CHANGE TO ANY LARGE DEGREE. FRONTAGES FOR THE INFANTRY BATTALION AND RIFLE COMPANY CONTAINED IN INFANTRY-75 WERE USED IN DETERMINING REQUIREMENTS AND ARE AS SHOWN HERE:

(SLIDE 21 ON)

THE FIGURES ARE FOR IDEAL TERRAIN CONDITIONS AND IN A WELL ESTABLISHED GEOGRAPHIC AREA.

(SLIDE 21 OFF)

THE INFANTRY DOCTRINAL REQUIREMENTS FOR SMALL ARMS AS DETERMINED BY THE ASARS STUDY GROUP ARE AS SHOWN ON THESE NEXT TWO SLIDES:

(SLIDE 22 ON )

(SLIDE 22 OFF)

(SLIDE 22A ON)

THE RANGE REQUIREMENT FIGURES ARE BASED ON FRONTAGES ESTABLISHED FOR A UNIT IN THE DEFENSE AND THE BASIC PRINCIPLE INVOLVED IN FIRE PLANNING FOR THE DEFENSE, GAPS BETWEEN UNITS CONSIDERED.

(SLIDE 22A OFF)

ANNEX I OR MISSION FREQUENCY IS IN RESPONSE TO THE ASARS I TASKS SHOWN ON THIS SLIDE.

(SLIDE 23 ON)

THE TASK WAS ALSO DESIGNED TO FILL A DATA GAP AND AS INDICATED ON THE FOLD-OUT MAY OR MAY NOT HAVE ANY APPLICATION TO ASARS II. IF IT DOES IT WILL BE IN THE FINAL ANALYSIS.

(SLIDE 23 OFF)

LITTLE INFORMATION THAT WILL ASSIST IN ACCOMPLISHING THIS ANNEX IS AVAILABLE. DATA ASSEMBLED AND ANALYZED IN IRUS PERTAINING TO THE RELATIVE IMPORTANCE OF THE OFFENSE VERSUS THE DEFENSE WILL BE USED. ALSO DATA ASSEMBLED BY THE COMBAT OPERATIONS FREQUENCY STUDY GROUP IS BEING EXAMINED. WE JUST RECENTLY RECEIVED THEIR LATEST COMPUTER PRINTOUT PERTAINING TO SMALL UNIT NIGHT COMBAT EXPERIENCE IN VIETNAM AND ARE NOW ANALYZING IT TO SEE WHAT APPLICATION IF ANY IT MAY HAVE IN MEETING THIS REQUIREMENT.

ANNEX J OF ASARS I IS IN RESPONSE TO THE REQUIREMENTS SHOWN ON THIS SLIDE. DATA CONTAINED IN THIS ANNEX WILL BE INPUT INTO SIMULATION AND WAS USED IN THE DEVELOPMENT OF TARGET ARRAYS.

(SLIDE 24 ON)

THIS SUBTASK HAS BEEN COMPLETED. INCLUDED IN THE ANNEX ARE FIVE ASSOCIATED APPENDIXES WHICH DISCUSS AND PROPOSE SOLUTIONS TO THE PROBLEMS ASSOCIATED WITH MODELING THE ENVIRONMENT FOR COMPUTER SIMULATIONS.

(SLIDE 24 OFF)

THE GEOGRAPHIC AREAS SELECTED ARE SHOWN ON THIS NEXT SLIDE.

(SLIDE 25 ON)

A GENERAL DESCRIPTION OF THE TERRAIN, VEGETATION AND CLIMATE PREVAILING IN EACH OF THESE AREAS IS PROVIDED ALONG WITH A BRIEF ANALYSIS OF THE AREA OF OPERATIONS TO INCLUDE WEATHER, IDENTIFICATION OF TERRAIN AND MAN-MADE FEATURES AND PREDOMINANT VEGETATION. THE MILITARY ASPECTS OF THE AREA ARE ALSO TREATED. THIS INFORMATION WAS USED IN THE PREPARATION OF THE TARGET ARRAYS.

(SLIDE 25 OFF)

THE ENVIRONMENT IS CONSIDERED TO BE COMPOSED OF THREE MAJOR COMPONENTS EACH OF WHICH ARE DISCUSSED INDIVIDUALLY IN THE ANNEX AS A CONDITION CAPABLE OF CONTRIBUTING TO THE DEGRADATION, OR ENHANCEMENT, OF COVER, CONCEALMENT AND MOBILITY.

THE THREE MAJOR COMPONENTS ARE SHOWN ON THIS NEXT SLIDE.

(SLIDE 26 ON)

MACRO-TERRAIN COVERS THE MAJOR TOPOGRAPHIC FEATURES WHILE MICRO-TERRAIN ADDRESSES MINOR SURFACE IRREGULARITIES. THE BOTANICAL MAKE-UP OF THE AREA IS PRESENTED UNDER THE THIRD MAJOR COMPONENT, VEGETATION.

(SLIDE 26 OFF)

THE ANNEX PRESENTS A COMPARISON OF TECHNIQUES USED IN EXISTING SIMULATION MODELS FOR SIMULATING THE ENVIRONMENTAL COMPONENTS AND THEIR EFFECTS ON COVER,

CONCEALMENT AND MOBILITY. THE TEXT CONTAINS DISCUSSIONS FOR MODIFICATIONS OR EXTENSIONS TO EXISTING MODELS DEEMED NECESSARY TO ACHIEVE THE LEVEL OF DETAIL REQUIRED FOR AN INFANTRY SIMULATION MODEL. THE ANNEX FURTHER CONTAINS A DETAILED DISCUSSION ON THE ANALYTICAL DETERMINATION OF LINE-OF-SIGHT. AN EXPLANATION AND APPLICATION OF THE FACTOR COMPLEX METHOD OF ENVIRONMENT DESCRIPTION DEVELOPED BY THE US ARMY ENGINEERS WATERWAYS EXPERIMENT STATION IS INCLUDED. THIS METHOD IS IDENTIFIED AS AN EXCELLENT SOURCE OF DATA TO IMPROVE THE APPLICATION OF EXISTING ENVIRONMENT MODELS AND A LIST OF PHYSICAL ENVIRONMENT FACTORS NECESSARY FOR DETERMINATION OF COVER, CONCEALMENT AND MOBILITY INDICES FOR THE GEOGRAPHIC AREAS BEING CONSIDERED IN ASARS. THIS CONCLUDES MY BRIEFING. I WILL BE FOLLOWED BY MAJOR DAVIS.

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THIS PORTION OF THE BRIEFING WILL ADDRESS THE ASARS II METHODOLOGY ANNEX AND ITS APPENDIXES. AS WE SAID AT THE FIRST IPR, THE INFANTRY AGENCY CONSIDERS THIS THE MOST CRITICAL OF ALL ASARS I TASKS. IT, OF COURSE, PROVIDES THE BASIC GUIDANCE AND METHODS TO BE EMPLOYED IN ACCOMPLISHING ASARS II SUCCESSFULLY. PRIOR TO GOING ON I WOULD LIKE TO REFRESH YOUR MEMORY OF THESE FOUR ASARS I TASKS:

(SLIDE 27 ON)

#### ASARS II METHODOLOGY

PREPARE A METHODOLOGY FOR THE CONDUCT OF ASARS II IN SUFFICIENT DETAIL TO ENSURE THAT THE OUTPUT OF ASARS I WILL CONTRIBUTE TO THE EFFICIENT ACCOMPLISHMENT OF THE ASARS II OBJECTIVES.

(SLIDE 27 OFF)

(SLIDE 28 ON)

#### COMPUTER SIMULATION

RECOMMEND A SIMULATION MODEL TO BE USED IN ACCOMPLISHING THE OBJECTIVES OF ASARS II

THE DECISION TO USE OPMOR HAS ALTERED THE SCOPE OF THIS TASK TO BE MORE APTLY TERMED SIMULATION REQUIREMENTS.

(SLIDE 28 OFF)

(SLIDE 29 ON)

#### MEASURES OF EFFECTIVENESS

ESTABLISH THE MEASURES OF AN THE METHODS FOR EVALUATING SMALL ARMS EFFECTIVENESS.

(SLIDE 29 OFF)

(SLIDE 30 ON)

#### WEAPON CHARACTERISTICS

DETERMINE, DEFINE, AND ESTABLISH MATHEMATICAL FUNCTIONAL RELATIONSHIPS AMONG MEASURABLE SMALL ARMS CHARACTERISTICS.

(SLIDE 30 OFF)

AS A FURTHER REVIEW I WOULD LIKE TO SHOW YOU THE ASARS II TASKS AS WE WILL BE REFERRING TO THEM THROUGHOUT THIS PORTION OF THE BRIEFING.

(SLIDE 31 ON)

#### ASARS II TASKS

1. MONITOR OTHER ARSAP TASKS
2. MODIFY AND USE SIMULATION
3. SMALL ARMS AS THEY RELATE TO SUPPORTING WEAPONS
4. CONTRIBUTION OF SMALL ARMS CHARACTERISTICS TO OVERALL COMBAT EFFECTIVENESS
5. QMDO
6. QMR

THE FIRST TASK IS NOT TREATED IN ANNEX K. HOWEVER, A PLAN WILL BE FORMULATED TO ENSURE THAT THIS IS SYSTEMATICALLY PLANNED AND ACCOMPLISHED TO PREVENT THE LOSS OF ANY VALUABLE DATA FROM OTHER ARSAP TASKS AND TO AVOID THE "REFLOWING OF THE SAME GROUND." IT IS ESSENTIAL THAT THE CONTRACTOR'S WORK PLAN FOR ASARS II INCLUDE THIS.

THE SECOND TASK, OF COURSE, WILL BE ACCOMPLISHED TO ALLOW THE SUCCESSFUL COMPLETION OF ASARS II. THIS TASK IS TREATED THROUGHOUT ANNEX K. THE THIRD TASK IS ADDRESSED WITHIN ANNEX K AS THE TASK THAT MUST BE ACCOMPLISHED PRIMARILY BY A JUDGMENTAL STUDY.

THE PRIMARY USE OF SIMULATION WILL BE USED TO SATISFY TASK IV OF ASARS II AND IS TREATED IN DETAIL WITHIN THE ASARS II METHODOLOGY. TASKS V AND VII, OF COURSE, ARE ADDRESSED AS THE ULTIMATE GOAL OF ASARS I TO PROVIDE A PORTION OF THE DATA NECESSARY TO SUPPORT THE PREPARATION OF MATERIEL REQUIREMENT DOCUMENTS.

(SLIDE 31 OFF)

ASARS II CONSISTS OF TWO DISTINCT PROCEDURES. ONE IS SIMULATION AND THE OTHER IS JUDGMENTAL STUDIES ADDRESSING QUESTIONS THAT CANNOT BE TREATED THROUGH SIMULATION. WHILE THE ASARS II METHODOLOGY ADDRESSES THESE JUDGMENTAL STUDIES, THE BULK OF THIS ANNEX IS ORIENTED TOWARD USE OF SIMULATION. THE FOLD-OUT IN

TAB G OF YOUR IPR BOOKLET WILL BE USED TO GUIDE YOU THROUGH THE SIMULATION PORTION OF ASARS II.

THE INITIAL PROBLEM WE FACED REGARDING SIMULATION WAS THE MODEL, ITS CAPABILITY, THE MODIFICATIONS REQUIRED, AND ITS AVAILABILITY. A SIGNIFICANT PORTION OF THIS TASK WAS ELIMINATED FROM THE PURVIEW OF THE INFANTRY AGENCY BY THE DECISION TO USE OPMOR FOR ASARS II SIMULATION. THE AGENCY, HOWEVER, DID USE A MAJOR PORTION OF ANNEX K WITH ITS APPENDIXES TO PREPARE A LIST OF SIMULATION REQUIREMENTS AND CHARACTERISTICS THAT WE MUST HAVE IN AN INFANTRY MODULE TO SATISFACTORILY CONDUCT ASARS II SIMULATION. THE FOLLOWING TWO SLIDES REFLECT THESE REQUIREMENTS THAT WE PROVIDED ISA FOR ASSISTANCE IN DEVELOPING AND MODIFYING OPMOR. THIS SLIDE DISPLAYS THE DEFINITE SIMULATION OUTPUT REQUIREMENTS.

(SLIDE 32 ON)

#### DEFINITE OUTPUT REQUIREMENTS

- a. RED CASUALTIES (TOTAL)
- b. BLUE CASUALTIES (TOTAL)
- c. RED EQUIPMENT LOSSES (TOTAL BY EQUIPMENT TYPE)
- d. BLUE EQUIPMENT LOSSES (TOTAL BY EQUIPMENT TYPE)
- e. RED ROUNDS EXPENDED (TOTAL BY TYPE)
- f. BLUE ROUNDS EXPENDED (TOTAL BY TYPE)
- g. RED TOTAL TIME SUPPRESSED (BY TARGET TYPE)
- h. BLUE TOTAL TIME SUPPRESSED (BY TARGET TYPE)
- i. BATTLE TIME (TOTAL DURATION)

(SLIDE 32 OFF)

THE SECOND LIST IS THOSE OUTPUTS WHICH ARE HIGHLY PROBABLE OUTPUTS FROM SIMULATION.

(SLIDE 33 ON)

#### DESIRABLE SIMULATION OUTPUT REQUIREMENTS

- a. REDUCTION IN FIREPOWER (IF DEFINABLE)
- b. EACH OF THE DEFINITE REQUIREMENTS, a-h, RUNNING TOTALS W/TIME (X MINUTE INCREMENTS) WHERE X IS INPUT.
- c. MEAN TIME EACH TARGET TYPE IS PINPOINTED (i.e., EXPOSED AND VULNERABLE TO AIMED FIRE.)
- d. TOTAL HITS PER WPN/TGT COMBINATION
- e. MEAN TOTAL TIME EACH WPN TYPE IS IN PROCESS OF DELIVERING AIMED FIRE.
- f. MEAN TOTAL TIME EACH WPN TYPE IS IN PROCESS OF DELIVERING UNAIED FIRE.

(SLIDE 33 OFF)

WITHOUT APPENDIX I TO ANNEX K, THE AGENCY WOULD HAVE BEEN HARD PRESSED TO HAVE PROMPTLY RESPONDED TO ISA'S REQUEST FOR OUR NEEDS. REGARDING OUR ASARS I TASK OF RECOMMENDING A SIMULATION MODEL, WE CONCENTRATED OUR PRIMARY ATTENTIONS ON THE FOLLOWING ISSUES:

(SLIDE 34 ON)

#### ASARS II SIMULATION REQUIREMENTS

1. ESTABLISH THE PARAMETERS AND CHARACTERISTICS OF COMBAT WHICH ARE TO BE SIMULATED IN ASARS II.
2. IDENTIFY THE TREATMENT OF THESE PARAMETERS AND CHARACTERISTICS.
3. IDENTIFY THE GENERAL INPUTS REQUIRED FOR EACH PARAMETER AND SIMULATION CHARACTERISTIC
4. IDENTIFY THE OUTPUTS REQUIRED

(SLIDE 34 OFF)

THE PRIMARY USE OF SIMULATION, AS I STATED EARLIER, WILL BE TO SATISFY TASK IV OF ASARS II:

(SLIDE 35 ON)

#### TASK IV OF ASARS II

DETERMINE THE RELATIVE CONTRIBUTIONS OF VARIOUS SMALL ARMS CHARACTERISTICS TO OVERALL COMBAT EFFECTIVENESS FOR EACH CONFLICT INTENSITY IN ATTACK, DEFENSE, AND MEETING ENGAGEMENT IN THE VARIOUS AREAS CONCERNED.

AS WE STATED EARLIER, OPMOR WILL NOT PERMIT THE TOTAL ACCOMPLISHMENT OF THIS TASK SINCE IT WILL SIMULATE ONLY A MID INTENSITY CONFLICT.

(SLIDE 35 OFF)

TO THE EXTENT THAT WEAPON CHARACTERISTICS AND COMBAT EFFECTIVENESS CAN BE QUANTIFIED, THIS PROBLEM IS ONE OF DETERMINING THE FUNCTIONAL RELATIONSHIP BETWEEN WEAPONS CHARACTERISTICS AND EFFECTIVENESS. THIS WILL BE ACCOMPLISHED THROUGH SIMULATION.

THE ACTUAL USE OF SIMULATION CAN BE DIVIDED INTO FIVE STAGES AS SHOWN  
HERE :

(SLIDE 36 ON)

SIMULATION

1. PREPARATION
2. PRELIMINARY EXPERIMENT
3. BASIC EXPERIMENT
4. FOLLOW-ON EXPERIMENT
5. SIMULATION ANALYSIS

(SLIDE 36 OFF)

PREPARATION STAGE

THE PREPARATION STAGE INCLUDES ALL OF ASARS I AND EXTENDS INTO ASARS II. THE ESSENTIAL GOAL OF THIS PERIOD IS TO BE READY TO CONDUCT SIMULATION WHEN THE OPMOR MODEL IS DELIVERED TO THE ASARS TEAM. TO MEET THIS GOAL WE MUST OBTAIN THE INFORMATION REQUIRED FOR SIMULATION, CODE THIS INFORMATION, SO THAT IT IS STATED IN TERMS ACCEPTABLE AS INPUT DATA TO SIMULATIONS AND, OF COURSE, HAVE THE CODED DATA PLACED ON PUNCH CARDS FOR USE IN THE COMPUTER. THERE ARE THREE BASIC CATEGORIES OF INPUT REQUIRED FOR SIMULATION:

(SLIDE 37 ON)

REQUIRED SIMULATION DATA CATEGORIES

1. TERRAIN AND VEGETATION DATA
2. SCENARIO AND GENERAL DATA
3. EQUIPMENT DATA

(SLIDE 37 OFF)

TREATMENT OF THE TERRAIN AND VEGETATION DATA HAS BEEN DISCUSSED BY LTC BUSHAW. WITHIN ASARS II, SUCH DATA MUST BE CODED FOR THE UNIQUE REQUIREMENTS OF THE OPMOR MODEL.

A MASS OF INFORMATION WILL COME FROM THE SECOND CATEGORY. WE HAVE INCLUDED ALL INPUT DATA THAT DOES NOT RELATE TO ENVIRONMENT OR HARDWARE IN THIS

SCENARIO AND GENERAL DATA CATEGORY. THE SCENARIOS EITHER IMPACT ON THE OTHER DATA, OR VICE VERSA. THE SCENARIOS WILL BE DEVELOPED BY THE ASARS TEAM WITH ASSISTANCE FROM THE CONTRACTOR. THE FOLLOWING SLIDE DISPLAYS THE PRIMARY MATERIAL CONTAINED IN THIS CATEGORY AND THE SOURCE OF THESE DATA.

(SLIDE 38 ON)

SCENARIO AND GENERAL DATA

1. ENEMY TROOP DISPOSITION AND SCHEME OF MANEUVER
2. FRIENDLY TROOP DISPOSITION AND SCHEME OF MANEUVER
3. SUPPORT FIRE PLAN
4. TERMINATION OR DEFEAT CRITERIA
5. TARGET DESCRIPTION AND PRIORITIES
6. DETECTION PARAMETERS
7. MOVEMENT RATES
8. VULNERABILITY INDEXES
9. SUPPRESSION THRESHOLDS AND DURATION
10. AMMUNITION EXPENDITURE INSTRUCTIONS

(SLIDE 38 OFF)

THE FINAL CATEGORY OF REQUIRED INFORMATION IS THAT DATA DESCRIBING SPECIFIC ITEMS OF EQUIPMENT TO BE SIMULATED. THREAT EQUIPMENT IS IDENTIFIED IN THE ASARS THREAT ANNEX. DETAILED DATA DESCRIBING THIS EQUIPMENT IS TO BE EXTRACTED FROM THE SUPPORTING DOCUMENTS USED IN FORMULATION OF THREAT-85. THIS DATA MUST BE AGREED UPON BY THE THREAT COMMUNITY, ESPECIALLY THE FOREIGN SCIENCE AND TECHNOLOGY CENTER. WE HAVE ASSUMED THAT SPECIFIC DATA DESCRIBING FRIENDLY SUPPORTING WEAPONS IS AVAILABLE. THE EXACT SOURCE MUST BE IDENTIFIED AND OBTAINED - "LEGAL MIX" PROBABLY WILL PROVIDE MOST OF THIS DATA. THE MOST CRUCIAL EQUIPMENT DATA, OF COURSE, IS THAT DESCRIBING THE FRIENDLY SMALL ARMS. THIS DATA IS CONTAINED IN APPENDIX III, THE WEAPON CHARACTERISTICS, OF ANNEX K.

THE WEAPONS CHARACTERISTICS APPENDIX TO THE ASARS II METHODOLOGY WAS DEVELOPED TO PROVIDE A BASIS FOR OUR TREATMENT OF SMALL ARMS WEAPONS CHARACTERISTICS

WITHIN THE SIMULATION. IN DEVELOPING THIS APPENDIX, THE APPROACH FOLLOWED WAS TO ATTEMPT TO FIND DOCUMENTED RELATIONS BETWEEN WEAPONS CHARACTERISTICS AND A GENERAL INDICATOR OF WEAPONS PERFORMANCE. THE INDICATOR OF PERFORMANCE USED WAS  $P_K$ , DEFINED AS THE PROBABILITY OF INCAPACITATING A TARGET WITH ONE OPERATION OF THE WEAPON, THAT IS, WITH ONE TRIGGER PULL. THE MOST BASIC CHARACTERISTICS CONSIDERED ARE SHOWN ON THIS SLIDE:

(SLIDE 39 ON)

NOTE THAT THESE ARE SEPARATED INTO WEAPON PERFORMANCE CHARACTERISTICS, WHICH INDICATE SOME TYPE OF WEAPON OPERATION IN A TACTICAL SITUATION, AND PHYSICAL CHARACTERISTICS, OR BASIC PHYSICAL QUANTITIES OF A PIECE OF HARDWARE.

(SLIDE 39 OFF)

WITHIN THIS APPENDIX, FIVE GENERAL CATEGORIES OF WEAPONS ARE CONSIDERED, AS ENUMERATED HERE:

(SLIDE 40 ON)

#### FIVE GENERAL CATEGORIES OF WEAPONS

1. SINGLE PROJECTILE, SEMI-AUTOMATIC
2. SINGLE PROJECTILE, AUTOMATIC BURST
3. MULTIPLE PROJECTILE (SALVO), SEMI-AUTOMATIC
4. AIMED MACHINEGUN AT AREA TYPE TARGET
5. AIMED FRAGMENTING ROUND, SEMI-AUTOMATIC, AT AREA TYPE TARGET

(SLIDE 40 OFF)

THERE ARE TWO CONCLUSIONS TO BE DRAWN FROM THIS APPENDIX, WHICH CLARIFY THE EXTENT TO WHICH WE WILL BE ABLE TO RELATE WEAPONS CHARACTERISTICS TO OVERALL COMBAT EFFECTIVENESS IN ASARS II. THE FIRST CONCLUSION IS THAT A SUFFICIENT BASIS EXISTS FOR RELATING BASIC PERFORMANCE CHARACTERISTICS OF THE WEAPON TO EFFECTIVENESS, USING SIMULATION. THESE BASIC PERFORMANCE CHARACTERISTICS FALL INTO THREE CATEGORIES: THE ABILITY TO HIT A TARGET, THE ABILITY TO INCAPACITATE

A TARGET AND RATES OF FIRE. A LISTING OF THE SPECIFIC CHARACTERISTICS IS SHOWN ON THIS EXHIBIT, FOR EACH WEAPON CATEGORY:

(SLIDE 41 ON)

FOR THE WEAPONS THAT FIRE NON-FRAGMENTING PROJECTILES, THE BASIC MEASURE OF ABILITY TO HIT A TARGET IS THE PROBABILITY OF HITTING A TARGET WITH ONE FIRING OF THE WEAPON,  $P_H$  PER TRIGGER PULL. THE ACTUAL WEAPON PERFORMANCE CHARACTERISTICS THAT WE PROPOSE TO RELATE TO EFFECTIVENESS ARE, IN THIS CASE: FOR SEMI-AUTOMATIC FIRE OF A SINGLE PROJECTILE, TACTICAL AIMING ERROR; FOR AUTOMATIC BURST FIRE OF SINGLE PROJECTILES, TACTICAL AIMING ERROR OF THE FIRST ROUND IN THE BURST AND ANGULAR DISPLACEMENT OF EACH SUCCESSIVE ROUND FROM POINT OF IMPACT TO THE FIRST ROUND; FOR SEMI-AUTOMATIC FIRE OF MULTIPLE PROJECTILE ROUNDS, TACTICAL AIMING ERROR AND DISPERSION OF THE PROJECTILES IN A ROUND ABOUT THEIR CENTER OF IMPACT; FOR MACHINEGUNS, TACTICAL AIMING ERROR OF THE FIRST ROUND IN A BURST AND THE OFFSET AND DISPERSION OF THE SUCCESSIVE ROUNDS. THE ANALOGOUS CHARACTERISTICS TO BE TREATED FOR FRAGMENTING AMMUNITIONS ARE TACTICAL FIRING ERRORS IN RANGE AND IN AZIMUTH. FOR WEAPONS FIRING A NON-FRAGMENTING PROJECTILE, THE BASIC MEASURE OF ABILITY TO INCAPACITATE A TARGET IS  $P_{HK}$ , THE PROBABILITY OF INCAPACITATING GIVEN A HIT RANDOMLY PLACED ON THE TARGET. THIS IS THE PERFORMANCE CHARACTERISTIC THAT WILL BE RELATED TO EFFECTIVENESS. FOR WEAPONS FIRING FRAGMENTING PROJECTILES, LETHAL AREA OF THE ROUND WILL BE RELATED TO EFFECTIVENESS. THE TACTICAL RATE OF FIRE, IN TRIGGER PULLS PER MINUTE, WILL BE RELATED TO EFFECTIVENESS FOR EACH OF THE WEAPONS CATEGORIES. FOR MACHINEGUNS, SUSTAINED RATE OF FIRE, IN TERMS OF ROUNDS PER MINUTE WILL ALSO BE TREATED.

(SLIDE 41 OFF)

THE SECOND CONCLUSION DRAWN WITHIN OUR WEAPONS CHARACTERISTICS APPENDIX IS THAT THERE DOES NOT EXIST A SOUND BASIS FOR THE CONDUCT OF DETAILED TRADE-OFFS AMONG PERFORMANCE AND PHYSICAL CHARACTERISTICS WITHIN ASARS II. THIS CONCLUSION HAS BEEN IMPORTANT IN OUR DEVELOPMENT OF THE ASARS II METHODOLOGY. BECAUSE OF THIS CONCLUSION, OUR GOAL IN ASARS II IS TO DEVELOP A MEANS WITH WHICH COMBAT EFFECTIVENESS CAN BE PREDICTED FOR ANY REASONABLE SET OF PERFORMANCE CHARACTERISTICS, AS WILL BE SEEN AS WE PROGRESS INTO OUR DISCUSSION OF THE METHODOLOGY. THUS, WE DO NOT PROPOSE TO CONDUCT DETAILED TRADE-OFFS WITHIN ASARS II BECAUSE WE DO NOT FEEL THAT WE HAVE A SUFFICIENT BASIS FOR THE ENUMERATION OF ALL OF THE POTENTIAL TRADE-OFFS. RATHER, WE WILL PROVIDE A BASE OF INFORMATION FROM WHICH THE IMPACT OF A TRADE-OFF ON COMBAT EFFECTIVENESS CAN BE EASILY DETERMINED, AS THE TRADE-OFFS BECOME IDENTIFIED WITHIN THE WEAPONS DEVELOPMENT CYCLE.

THE WEAPONS CHARACTERISTICS APPENDIX DOES CONTAIN SOME INFORMATION INTERRELATING THE VARIOUS PHYSICAL AND PERFORMANCE CHARACTERISTICS. WHILE THIS IS INSUFFICIENT FOR THE CONDUCT OF DETAILED TRADE-OFFS, IT IS SUFFICIENT TO PERMIT THE TENTATIVE IDENTIFICATION OF REASONABLE LIMITS ON MOST OF THE PERFORMANCE CHARACTERISTICS. FOR EXAMPLE, THERE IS A GOOD INDICATION THAT TACTICAL AIMING ERROR TENDS TO DECREASE AS MUZZLE RECOIL IS DECREASED. IF THIS RELATION IS EXTENDED TO A LEVEL OF NO RECOIL, WE HAVE IDENTIFIED A TACTICAL AIMING ERROR BELOW WHICH IT IS NOT WORTHWHILE TO CONDUCT SIMULATIONS.

THE FINAL STEP IN THE PREPARATION STAGE WILL BE THE DESCRIPTION AND CODING OF THE VOLUMINOUS INPUT DERIVED FROM THE CATEGORIES OF REQUIRED SIMULATION DATA.

#### PRELIMINARY EXPERIMENT STAGE

PRIOR TO THE INITIATION OF A LENGTHY SERIES OF SIMULATION RUNS, A LIMITED PRELIMINARY EXPERIMENT WILL BE CONDUCTED. THIS EXPERIMENT IS INTENDED TO INVESTIGATE SIMULATION VALIDITY AND SENSITIVITY.

TO VERIFY OR VALIDATE A MODEL MEANS TO PROVE THAT THE MODEL IS TRUE. FOR THE PURPOSES OF ASARS WE WILL ASSUME THE SIMULATION IS VALID IF IN THE OPINION OF AGENCY PERSONNEL, IT GIVES A REASONABLE REPRESENTATION OF THE INTERACTION OF TWO OPPOSING FORCES IN A SIMULATED COMBAT ENVIRONMENT. TO FACILITATE THIS JUDGMENT, THE PRELIMINARY EXPERIMENT WILL CONTAIN SEVERAL BASELINE SITUATIONS IN WHICH CURRENTLY STANDARD SMALL ARMS ARE REPRESENTED.

SHOULD THE MODEL APPEAR TO LACK VALIDITY, APPROPRIATE MODIFICATIONS TO THE MODEL CAN BE MADE DURING THE PRELIMINARY INVESTIGATION.

THE PURPOSE OF THE SENSITIVITY ANALYSIS IS TO IDENTIFY THOSE MODEL PARAMETERS WHICH HAVE A SIGNIFICANT INFLUENCE ON THE SIMULATION RESULTS, OR MORE TO THE POINT ON OUR MEASURE OF EFFECTIVENESS. WE SAID AT THE LAST IPR THAT MISSION ACCOMPLISHMENT WOULD BE EXAMINED AS OUR PRIMARY MOE. THE MOE OF MISSION ACCOMPLISHMENT IS THE MOST DESIRABLE; HOWEVER, VALUES FOR THE MOE MAY NOT BE OBTAINABLE. A DOMINATING FACTOR THAT DETERMINES THE USE OF AN MOE IS ITS ABILITY TO BE MEASURED. ADDITIONALLY, IT SHOULD BE INCLUSIVE. FOR EXAMPLE, MISSION ACCOMPLISHMENT OF AN INFANTRY UNIT INCLUDES WEAPONS CHARACTERISTICS, AS WELL AS THE ENVIRONMENT OF THE WEAPONS.

WE INCLUDE THE FOLLOWING IN THE ENVIRONMENT OF AN INFANTRY UNIT.

(SLIDE 42 ON)

#### ENVIRONMENT OF INFANTRY UNITS

ENVIRONMENTAL EFFECTS  
RED CAPABILITY  
BLUE CAPABILITY  
MISSION STATEMENT  
MISSION OUTCOME

(SLIDE 42 OFF)

AND OF VITAL IMPORTANCE IS THE FACT THAT MISSION ACCOMPLISHMENT IS A SINGLE MEASURE.

IN SUMMARY WE CAN SAY THERE ARE FOUR ADVANTAGES OF USING MISSION ACCOMPLISHMENT AS OUR PRIMARY MOE:

(SLIDE 43 ON)

MISSION ACCOMPLISHMENT AS MOE ADVANTAGES

1. SINGLE MEASURE
2. REFLECTS TOTAL ENVIRONMENT OF SMALL ARMS
3. REFLECTS THE EFFECTS OF SMALL ARMS
4. EASILY UNDERSTOOD BY CIVILIAN AND MILITARY

(SLIDE 43 OFF)

THE PRELIMINARY EXPERIMENT STAGE OF SIMULATION IS WHERE THIS EXAMINATION OF MISSION ACCOMPLISHMENT AS OUR PRIMARY MOE WILL OCCUR. IF THE NECESSARY SENSITIVITY OF MISSION ACCOMPLISHMENT IS NOT GUARANTEED WE WILL SHIFT OUR PRIMARY MOE TO THE SMALL ARMS INDICATORS (SAI) AS SHOWN HERE:

(SLIDE 44 ON)

SMALL ARMS INDICATORS

BLUE CASUALTIES - RED CASUALTIES  
BLUE SUPPRESSION - RED SUPPRESSION  
TIME - DISTANCE

IN PARTICULAR MISSIONS, THESE MOE MAY OR MAY NOT BE APPLICABLE. HOWEVER, IN CONSIDERING THE OVER-ALL SITUATIONS, THESE MOE IMPACT ON MISSION ACCOMPLISHMENT OF THE SMALL INFANTRY UNIT. THUS, WHEN USING THESE MOE, MILITARY JUDGMENT MUST BE EXERCISED TO DETERMINE THE VALUE OF EACH IN THE PARTICULAR SITUATION.

BLUE CASUALTIES AND RED CASUALTIES. RED CASUALTIES INDICATE BLUE FIREPOWER, WHILE BLUE CASUALTIES INDICATE COST IN THE SAME MISSION. IN THE COMPARISON OF CASUALTIES AS AN MOE TO MISSION ACCOMPLISHMENT CASUALTIES ARE A DIRECT

INDICATOR OF THE EFFECT OF SMALL ARMS. ALSO, IN A MODELED SITUATION, THIS MOE HAS A WIDE RANGE OF VALUES.

BLUE SUPPRESSION AND RED SUPPRESSIONS. SUPPRESSION IS DIFFICULT TO MEASURE SINCE IT IS DUE TO A COMBINATION OF FACTORS SUCH AS SOUND, PROXIMITY OF THE PREVIOUS ROUNDS, AND OTHER SUCH FACTORS. HOWEVER, EVEN APPROXIMATE MEASURES OF SUPPRESSION PROVIDE AN IMPORTANT PART OF THE TOTAL EFFECTS OF SMALL ARMS.

TIME. TIME IN A GIVEN SITUATION COULD BE THE MOST IMPORTANT MOE, WHILE IN A DIFFERENT SITUATION, COULD BE THE LEAST IMPORTANT. HOWEVER, EVEN IF TIME IS NOT IMPORTANT, IT PROVIDES A BASE FOR THE COMPARISON OF OTHER MOE.

DISTANCE. DISTANCE IS SIMILAR TO TIME IN THE SENSE THAT FOR A PARTICULAR MISSION THE DISTANCE FROM AN OBJECTIVE MAY OR MAY NOT BE SIGNIFICANT. HOWEVER, IF ALL OTHER SAI ARE EQUAL, IT COULD BE USED TO DISCRIMINATE IN THOSE SITUATIONS IN WHICH IT IS APPLICABLE. ADDITIONALLY, LIKE TIME IT MAY BE USED AS A BASE TO COMPARE OTHER MOE.

(SLIDE 44 OFF)

THE SAI, DOUBTLESSLY, ARE MORE SENSITIVE TO CHANGES IN WEAPONS CHARACTERISTICS THAN MISSION ACCOMPLISHMENT, BUT WE WILL BE FACED WITH THE DISADVANTAGES OF USING MULTIPLE MOE AND THE EXTREME VARIANCE OF IMPORTANCE FROM MISSION TO MISSION.

SINCE THE MODEL PARAMETERS DESCRIBING WEAPON CHARACTERISTICS ARE OF PRIME IMPORTANCE IN ASARS, AN ADDITIONAL PURPOSE OF THE SENSITIVITY ANALYSIS IS TO ENSURE THAT THE MODEL IS SENSITIVE TO APPROPRIATE WEAPONS PARAMETERS AND IDENTIFY OTHER PARAMETERS TO WHICH THE MODEL IS SENSITIVE.

AS WE STATED EARLIER, THE PRIMARY PARAMETERS DESCRIBING WEAPON CHARACTERISTICS ARE EXPECTED TO BE ACCURACY, INCAPICITATION, AND RATE OF FIRE. THE QUANTIFICATION OF THESE FACTORS DEPENDS ON THE PARAMETERIZATION DEVELOPED IN CANDIDATE WEAPONS

DEVELOPMENT. AS A MINIMUM THE SENSITIVITY ANALYSIS SHOULD ENSURE THAT THE MODEL IS RESPONSIVE TO CHANGE IN THESE FACTORS. IF THE MODEL SHOULD PROVE INSENSITIVE TO THESE FACTORS, SOME MODEL MODIFICATIONS WILL BE REQUIRED.

THE PRELIMINARY SIMULATION WILL CONTAIN A NUMBER OF PARAMETERS WHOSE VALUES WILL BE SET AT ARBITRARY LEVELS, EITHER BECAUSE TRUE VALUES ARE INSUFFICIENTLY KNOWN OR BECAUSE A WIDE RANGE OF VALUES ARE POSSIBLE. THESE PARAMETERS CANNOT BE DEFINITELY ESTABLISHED AT THIS TIME SINCE THE SIMULATION MODEL HAS NOT BEEN COMPLETED. BASED ON KNOWLEDGE OF EXISTING SIMULATIONS, IT IS POSSIBLE TO PROJECT THAT SUCH ARBITRARILY SET PARAMETERS WILL MOST LIKELY BE THOSE ASSOCIATED WITH TERRAIN FACTORS, TACTICAL DECISIONS, AND THE DEGREE OF SUPPORTING WEAPONS. A SENSITIVITY ANALYSIS PERMITS IDENTIFICATION OF THOSE ARBITRARILY SET PARAMETERS TO WHICH RESULTS ARE SENSITIVE. THE ARBITRARINESS OF SUCH PARAMETERS SHOULD BE REMOVED, INsofar AS IS POSSIBLE, BY FURTHER RESEARCH. WHERE THIS IS IMPRACTICAL, THESE PARAMETERS AND THEIR FUTURE EFFECTS MUST BE CONSIDERED IN THE SYNTHESIS OF SIMULATION RESULTS. THOSE ARBITRARILY SET PARAMETERS TO WHICH THE SIMULATION IS NOT SENSITIVE SHOULD PRESENT NO PROBLEM.

THE ACTUAL CONDUCT OF THIS PRELIMINARY EXPERIMENT WILL BE ACCOMPLISHED USING A LIMITED SUBSET OF THE POSSIBLE COMBAT SIMULATIONS, PROBABLY THREE OR FOUR. THE FOLLOWING SEQUENCE OF STEPS WILL BE CARRIED OUT FOR EACH SITUATION.

(SLIDE 45 ON)

- a. STEP 1 - CONDUCT AN ARBITRARY NUMBER OF SIMULATION RUNS USING INPUT DATA WHICH DESCRIBE BASELINE WEAPONS. SIX REPLICATIONS SHOULD BE SUFFICIENT.
- b. STEP 2 - CHECK THE RESULTS OF STEP 1 FOR VALIDITY BY APPLYING MILITARY JUDGMENT.
- c. STEP 3 - MODIFY THE MODEL IF NECESSARY. IF THE MODEL IS MODIFIED, STEPS 1 AND 2 WILL BE REPEATED.

- d. STEP 4 - CALCULATE THE LEVEL OF REPLICATION REQUIRED FOR SENSITIVITY TESTS. IF MORE THAN ONE MOE IS BEING USED, MORE THAN ONE CALCULATION IS REQUIRED AND THE LEVEL OF REPLICATION CAN BE EITHER THE HIGHEST REQUIRED OF ALL MEASURES OR THAT REQUIRED BY THE MOST IMPORTANT MEASURE.
- e. STEP 5 - CONDUCT THE SIMULATION RUNS NEEDED FOR THE SENSITIVITY ANALYSIS. FOR EACH PARAMETER BEING INVESTIGATED TWO SETS OF RUNS ARE REQUIRED, ONE WITH THE PARAMETER SET TO A VALUE ABOVE THAT USED IN THE BASELINE RUNS AND ONE WITH A VALUE BELOW THAT OF THE BASELINE RUNS.
- f. STEP 6 - CONDUCT THE SENSITIVITY ANALYSIS BY COMPARING THE RESULTS OF THE TWO SETS OF RUNS FROM STEP 5 WITH THE BASELINE RESULTS.
- g. STEP 7 - TAKE ACTION AS REQUIRED ON THE BASIS OF THE SENSITIVITY TESTS TO MODIFY THE MODEL OR IMPROVE PARAMETER VALUES.

(SLIDE 45 OFF)

ONCE THE VALIDITY AND SENSITIVITY OF THE MODEL HAVE BEEN ESTABLISHED WE WILL BE ABLE TO PROGRESS INTO THE ACTUAL PRODUCTION RUNS OF THE SIMULATION MODEL TO SATISFY THE STUDY GOALS. BEFORE DISCUSSION OF THE PRODUCTION RUNS, TO BE CONDUCTED IN THE BASIC AND FOLLOW-ON EXPERIMENTATION STAGES, WE WILL IDENTIFY THE ANALYSIS TECHNIQUE TO BE USED IN ASARS II. THE ANALYSIS OF RESULTS OF A MONTE CARLO SIMULATION MUST BE BASED UPON SOUND STATISTICAL TECHNIQUES. SINCE THE PRIMARY SIMULATION PROBLEM IS TO DETERMINE THE FUNCTIONAL RELATIONSHIP BETWEEN COMBAT EFFECTIVENESS AND WEAPONS CHARACTERISTICS STATISTICAL TECHNIQUES FOR SOLVING THIS GENERAL TYPE OF PROBLEM ARE TO BE CONSIDERED. THE TWO MOST APPROPRIATE TECHNIQUES APPEAR TO BE MULTIPLE REGRESSION ANALYSIS AND THE ANALYSIS OF VARIANCE (ANOVA).

a. REGRESSION ANALYSIS IS, IN SIMPLE TERMS, A CURVE-FITTING TECHNIQUE. THAT IS, IT PERMITS THE PLOTTING OF A STATISTICALLY BASED CURVE THROUGH A NUMBER OF DATA POINTS, GATHERED THROUGH EXPERIMENTATION OR OBSERVATION. FOR PURPOSES OF DISCUSSION, WE HAVE ASSUMED THAT DATA IS TO BE GATHERED FOR VARIOUS VALUES OF WEAPONS CHARACTERISTICS -- ACCURACY, INCAPACITATION AND RATE OF FIRE.

IN THIS CASE REGRESSION GENERALIZES TO THE FITTING OF A SURFACE RATHER THAN A CURVE. THE MOST ATTRACTIVE FEATURE OF A REGRESSION EQUATION IS THE EASE WITH WHICH IT CAN BE USED TO PREDICT THE RESPONSE THAT WOULD BE EXPECTED FOR ANY INTERMEDIATE VALUE OF THE WEAPON CHARACTERISTIC, THAT IS, FOR VALUES OF THE WEAPON CHARACTERISTIC AT WHICH OBSERVATIONS ARE NOT AVAILABLE.

b. ANOVA IS A TECHNIQUE TO PERMIT DETERMINATION OF THE DEGREE TO WHICH SPECIFIC CHANGES IN VARIOUS FACTORS CONTRIBUTE TO THE CHANGE IN A RESPONSE VARIABLE. IN TERMS OF ASARS, IT PERMITS ESTIMATION OF THE DEGREE TO WHICH CHANGES IN WEAPON CHARACTERISTICS CONTRIBUTE TO A CHANGE IN COMBAT EFFECTIVENESS. PERHAPS THE MOST VERSATILE AND MOST BROADLY USED EXPERIMENTAL DESIGN USED WITH ANALYSIS OF VARIANCE IS THE "FACTORIAL". THE FACTORIAL DESIGN IS OBTAINED BY PRE-DETERMINING A SET OF VALUES FOR EACH OF THE VARIABLES TO BE CONSIDERED AND CONDUCTING EXPERIMENTS AT EACH POSSIBLE COMBINATION OF THESE LEVELS OF THE VARIABLES. THE FACTORIAL DESIGN IS USED WHEN A NUMBER OF FACTORS (IN OUR CASE WEAPONS CHARACTERISTICS) MUST BE INVESTIGATED OVER A RANGE OF VALUES AND IT IS DESIRED TO KNOW THE RESULT OF CHANGING EACH FACTOR INDEPENDENTLY OF THE OTHERS AS WELL AS THE RESULT OF CHANGING MORE THAN ONE FACTOR SIMULTANEOUSLY. THE DETERMINATION OF THE FUNCTIONAL RELATIONSHIP BETWEEN COMBAT EFFECTIVENESS AND WEAPONS CHARACTERISTICS DOES NOT AUTOMATICALLY FALL OUT OF THE ANOVA PROCEDURE BUT CAN BE OBTAINED THROUGH MATHEMATICAL MANIPULATION OF THE ANOVA RESULTS.

COMPARISON OF TECHNIQUES. THERE IS A STRONG THEORETICAL RELATION BETWEEN REGRESSION AND ANOVA. OF MORE INTEREST, HOWEVER, ARE THE DIFFERENCES BETWEEN THE TWO TECHNIQUES. REGRESSION IS GENERALLY USED WHEN THE PROBLEM IS ONE OF PREDICTION WHILE ANOVA IS USED TO GIVE PRECISE MEASUREMENT OF DIFFERENCES. WITHIN ASARS, REGRESSION WOULD BE USED TO PREDICT EFFECTIVENESS BASED UPON WEAPONS CHARACTERISTICS WHILE ANOVA WOULD BE USED TO GIVE PRECISE MEASUREMENT OF

THE DIFFERENCE IN EFFECTIVENESS AMONG WEAPONS REPRESENTED BY SPECIFIC VALUES OF THE CHARACTERISTICS. THIS IS A MATTER OF EMPHASIS, SINCE EITHER APPROACH CAN BE USED TO PREDICT AND EITHER APPROACH CAN BE USED TO MEASURE DIFFERENCES.

REGRESSION ANALYSIS IS MORE READILY USED IN A SEQUENTIAL PROCESS OF INVESTIGATION. USING REGRESSION IT IS SIMPLE TO ADD NEW EXPERIMENTAL POINTS TO A DESIGN IF NECESSARY AND, IN FACT, IT IS NOT OVERLY DIFFICULT TO ADD ENTIRELY NEW FACTORS TO THE ANALYSIS. WITH ANOVA, THE ADDITION OF NEW EXPERIMENTAL FACTORS IS NOT AS EASY. THIS DIFFERENCE IS PRIMARILY DUE TO THE GREATER NUMBER OF ASSUMPTIONS SUPPORTING THE THEORY OF ANOVA MODELS, WHICH REQUIRE A MORE DELICATE BALANCE IN THE EXPERIMENTAL DESIGN.

WITH ANOVA, THE MOST CRUCIAL STEP IS DEVELOPMENT OF THE EXPERIMENTAL DESIGN. ONCE THE DESIGN IS PROPERLY FORMULATED, ANALYSIS FALLS OUT AUTOMATICALLY FOR THE TRAINED STATISTICIAN. WITH REGRESSION ANALYSIS, THE DESIGN IS NOT AS CRUCIAL AS THE ANALYSIS STAGE. IN FACT, SUCCESSFUL REGRESSION ANALYSIS CAN OFTEN BE CONDUCTED UPON A BODY OF DATA COLLECTED IN AN ENTIRELY HAPHAZARD MANNER, WITH LITTLE OR NO DESIGN AT ALL. THE ASARS II METHODOLOGY DEVELOPS REGRESSION ANALYSIS AS THE ANALYTIC TECHNIQUE TO BE USED. A REVIEW OF SUBTASK IV OF ASARS II

(SLIDE 46 ON)

#### SUBTASK IV

DETERMINE THE RELATIVE CONTRIBUTION OF VARIOUS SMALL ARMS CHARACTERISTICS TO OVERALL COMBAT EFFECTIVENESS....

(SLIDE 46 OFF)

MIGHT LEAD TO THE CONCLUSION THAT ANOVA WOULD HAVE A MORE APPROPRIATE EMPHASIS IF WE COULD DETERMINE BEFOREHAND THE EXACT VALUES OF EACH CHARACTERISTIC WE ARE INTERESTED IN, THAT IS, IF WE HAD CANDIDATE WEAPONS. HOWEVER, ONE CAN LOOK

AHEAD TO POTENTIAL APPLICATION OF THE STUDY BY THE INFANTRY AGENCY, IN WHICH IT WILL BE DESIRED TO ASSESS THE POTENTIAL OF A WEAPON WHOSE CHARACTERISTICS WERE NOT SPECIFICALLY INVESTIGATED DURING ASARS II. IN SUCH A CASE, THE ABILITY TO PREDICT POTENTIAL EFFECTIVENESS WOULD BE INVALUABLE. THUS, IT APPEARS REGRESSION ANALYSIS, WITH ITS EMPHASIS ON PREDICTION, IS MORE APPROPRIATE TO THE FUTURE NEEDS OF THE AGENCY. HAVING REACHED A DECISION TO USE REGRESSION ANALYSIS TECHNIQUES IN ASASRS, WE HAVE FORMULATED A PLAN FOR THE PRODUCTION RUNS THAT IS COMPATIBLE WITH THIS ANALYSIS TECHNIQUE. TWO CONSIDERATIONS MUST BE KEPT IN MIND. FIRST, REGRESSION DOES NOT REQUIRE A TOTAL EXPERIMENTAL DESIGN PRIOR TO INCEPTION OF THE INVESTIGATION. SECOND, REGRESSION ANALYSIS LENDS ITSELF TO SEQUENTIAL EXPERIMENTS, THAT IS TO SAY, THE RESULTS OF EARLY EXPERIMENTS CAN BE READILY USED TO INDICATE THE CONDITIONS UNDER WHICH LATER OBSERVATION WOULD BE THE MOST VALUABLE.

BEARING THIS IN MIND, WE HAVE DIVIDED THE PRODUCTION RUNS INTO A BASIC EXPERIMENT AND FOLLOW-ON EXPERIMENTATION.

#### THE BASIC EXPERIMENT STAGE

THE BASIC EXPERIMENT IS DESIGNED TO PRODUCE A LIMITED BODY OF EXPERIMENTAL DATA WHICH CAN BE RAPIDLY ANALYZED TO DETERMINE THE GENERAL NATURE OF THE UNDERLYING RELATION BETWEEN EFFECTIVENESS AND WEAPONS CHARACTERISTICS. INFORMATION DEVELOPED WITHIN THIS EXPERIMENT WILL PERMIT THE ASARS TEAM TO MAKE INTELLIGENT DECISIONS ON THE EXTENT AND NATURE OF FOLLOW-ON SIMULATION WHICH PROVIDES THE BULK OF EXPERIMENTAL DATA FOR ANALYSIS. THE BASIC EXPERIMENT WILL BE LIMITED TO THE SAME SUBSET OF COMBAT SITUATIONS USED IN THE PRELIMINARY EXPERIMENT. THE IDENTICAL PROCEDURE WILL BE EMPLOYED FOR EACH OF THESE SITUATIONS.

AN EXPERIMENTAL DESIGN IS PROVIDED ONLY FOR THE BASIC EXPERIMENT. THIS REFERS TO AN IDENTIFICATION OF VALUES TO WHICH WEAPON CHARACTERISTICS PARAMETERS ARE TO BE SET FOR INPUT INTO SIMULATION. WHEN A SPECIFIC VALUE FOR EACH PARAMETER IS DESIGNATED, THESE VALUES CONSTITUTE AN EXPERIMENTAL POINT. THE BASIC DESIGN IS COMPOSED OF THREE GROUPS OF EXPERIMENTAL POINTS:

(SLIDE 47 ON)

TO ALLOW YOU TO VISUALIZE THE ARRANGEMENT OF EXPERIMENTAL POINTS, WE HAVE PREPARED A PICTURE OF THE DESIGN FOR THESE BASIC WEAPONS PARAMETERS, OR CHARACTERISTICS. IT SHOULD BE NOTED THAT THE SAME TYPE OF DESIGN IS, OF COURSE, AVAILABLE FOR ANY REASONABLE NUMBER OF CHARACTERISTICS.

THE CENTER POINT OF THE DESIGN SHOWN HERE, WILL BE A SET OF BASELINE VALUES. WE INTEND USING VALUES OF WEAPON CHARACTERISTICS DESCRIBING CURRENT WEAPONS. THUS, THE CENTER POINT IS THE SAME POINT AT WHICH THE FIRST SET OF RUNS WAS CONDUCTED IN THE PRELIMINARY EXPERIMENT.

WE THEN ESTABLISH A "STAR DESIGN" BY DEFINING EACH EXPERIMENTAL POINT ON THE STAR. THIS IS ACCOMPLISHED BY CHANGING ONE PARAMETER WHILE HOLDING ALL OTHER PARAMETERS AT THE BASELINE LEVEL. THE AMOUNT OF PARAMETER CHANGE IS SELECTED TO GIVE EXPERIMENTAL POINTS WHICH SPAN THE RANGE OF INTEREST FOR EACH PARAMETER. SOME WILL BE HIGHER AND SOME LOWER THAN THE BASELINE "CENTER POINT". THE SIMULATION RUNS CONDUCTED FOR SENSITIVITY ANALYSIS SHOULD INCLUDE DATA GATHERED AT THE EXPERIMENTAL POINTS OF THE STAR DESIGN.

(FLIP I ON)

NEXT WE ADD A SET OF FACTORIAL POINTS ABOUT THE CENTER. IN THE CASE OF THREE WEAPONS CHARACTERISTICS,  $2$  TO THE THIRD POWER, OR EIGHT POINTS ARE CONTAINED IN THIS SET. THE EXACT LEVEL AT WHICH CHARACTERISTICS ARE PLACED IN THIS SET OF POINTS DEPENDS ON THE LEVEL OF THE "STAR" POINTS. THIS IS A MATTER OF SCALING

USED TO PROVIDE DESIRED STATISTICAL CHARACTERISTICS WITHIN THE ENTIRE DESIGN. THIS IS DISCUSSED IN DETAIL WITHIN THE METHODOLOGY ANNEX.

(SLIDE 47 OFF)

ONCE THE EXPERIMENTAL DESIGN IS ESTABLISHED, THE BASIC EXPERIMENT IS CONDUCTED IN THE FOLLOWING MANNER FOR EACH COMBAT SITUATION.

(SLIDE 48 ON)

STEP 1 IS TO DETERMINE THE LEVEL OF REPLICATION. THE LEVEL OF REPLICATIONS USED IN SENSITIVITY TESTS IS GENERALLY SATISFACTORY. THE DESIGN CAN BE IMPROVED, HOWEVER, IF THE CENTER POINT RECEIVES MORE REPLICATION. A GOOD CRITERION IS TO SET THE LEVEL OF REPLICATION AT THE CENTER POINT SO THAT THE STANDARD ERROR OF THE ESTIMATED RESPONSE VARIABLE IS EQUAL BOTH AT THE CENTER AND AT ONE OF THE EXPERIMENTAL POINTS. THIS GIVES GENERALLY EQUAL ERROR OF PREDICTION OVER THE ENTIRE DESIGN. THE ACTUAL DETERMINATION OF THE REQUIRED LEVEL OF REPLICATION AT THE CENTER POINT INVOLVES A FAIRLY COMPLEX COMPUTATION AND WILL BE LEFT TO THE STATISTICIANS INVOLVED.

STEP 2 IS TO CONDUCT THE SIMULATION RUNS NEEDED TO COMPLETE THE DESIGN. THE RUNS FOR THE STAR DESIGN AND A PORTION OF THE CENTER POINT RUNS WILL HAVE ALREADY BEEN COMPLETED IN THE PRELIMINARY EXPERIMENT.

FOLLOWING STEP 2 WILL COME THE ANALYSIS (OR STEP 3). THE DATA IS ANALYZED TO DETERMINE THE BASIC RESPONSE FUNCTION (OR THE RELATIONSHIP BETWEEN EFFECTIVENESS AND WEAPONS CHARACTERISTICS) AND TO PROVIDE GUIDANCE FOR THE FOLLOW-ON EXPERIMENTS. THE BASIC DESIGN IS INTENDED TO GIVE THE ANALYST A SECOND ORDER RESPONSE SURFACE (OR A SECOND ORDER POLYNOMIAL IN THE PARAMETERS) WITH A MINIMAL AMOUNT OF EFFORT. IT IS ANTICIPATED THAT FOR FOLLOW-ON EXPERIMENTATION A COMPUTER PROGRAM CAPABLE OF PERFORMING STEPWISE MULTIPLE REGRESSION WILL BE AVAILABLE. THIS CAN BE USED IN THE ANALYSIS IF DESIRED, BUT IS NOT ACTUALLY

NECESSARY IN THIS STAGE, SINCE THE DESIGN POINTS ARE CHOSEN SUCH THAT THE MOST COMPLEX COMPUTATIONAL PROBLEM CAN BE ACCOMPLISHED MANUALLY IF NECESSARY.

IN ADDITION TO THE RESPONSE FUNCTIONS COMING FROM THE BASIC EXPERIMENT, THERE WILL ALSO BE STATISTICAL INDICATIONS OF HOW WELL THE FUNCTION EXPLAINS THE OBSERVED DATA. THIS INFORMATION IS USED TO DETERMINE THE EXTENT OF FOLLOW-ON EXPERIMENTATION REQUIRED.

(SLIDE 48 OFF)

#### FOLLOW-ON EXPERIMENTATION

THUS, FOLLOW-ON EXPERIMENTATION, OR COMPLETION OF THE PRODUCTION RUNS WILL DRAW UPON RESULTS OF THE BASIC EXPERIMENT TO FILL IN THE DATA REQUIRED ON THE TOTAL SET OF COMBAT SITUATIONS AND TO AMPLIFY THAT DATA WHERE REQUIRED. THE ENTIRE EXPERIMENTAL PLAN FOR ASARS II IS, IN ACTUALITY, A PLAN TO CONDUCT A NUMBER OF SIMILAR EXPERIMENTS, ONE FOR EACH SITUATION. A DETAILED PLAN OF FOLLOW-ON EXPERIMENTATION IS IMPRACTICAL AT THIS TIME, BECAUSE AREAS OF INTEREST FOR THE FOLLOW-ON EXPERIMENT WILL BE INDICATED BY THE REGRESSION ANALYSIS PERFORMED ON THE BASIC DATA. WHILE THERE IS NO GUARANTEE THE RESULTS FOR EACH SITUATION IN THE BASIC EXPERIMENT WILL BE THE SAME, IT SEEMS REASONABLE TO EXPECT RESULTS OVER MOST OF THE SITUATIONS TO BE SIMILAR SINCE THE PROCESSES BEING STUDIED ARE SIMILAR. THEREFORE, IT IS POSSIBLE TO DISCUSS FOLLOW-ON EXPERIMENTATION IN GENERAL TERMS, BASED UPON THE POSSIBLE OUTCOMES OF THE BASIC EXPERIMENT. FOR EACH SITUATION IN THE BASIC EXPERIMENT, FOUR OUTCOMES ARE POSSIBLE. THIS SLIDE IDENTIFIES THESE OUTCOMES AND INDICATES POTENTIAL COURSES OF ACTION ASSUMING SIMILAR RESULTS FOR EACH SITUATION.

(SLIDE 49 ON)

CASE 1. STATISTICAL ANALYSIS OF THE RESPONSE FUNCTION COULD INDICATE THAT NO USEFUL PREDICTION IS POSSIBLE. THIS WOULD HAPPEN IF EFFECTIVENESS WERE NOT SENSITIVE TO ANY OF THE WEAPONS CHARACTERISTICS BEING CONSIDERED. THE LIKELIHOOD OF SUCH A RESULT IS MINIMAL SINCE A SENSITIVITY ANALYSIS WILL HAVE BEEN CONDUCTED TO INSURE AGAINST SUCH A CASE. TWO BASIC OPTIONS APPEAR AVAILABLE UNDER SUCH A SITUATION. THE SIMULATION COULD BE DISCONTINUED OR THE STUDY COULD REVERT BACK TO THE PLANNING STAGE WITH A SERIES OF EXPLORATORY TRIALS DESIGNED TO HELP IDENTIFY NEW PARAMETERS.

CASE 2. STATISTICAL ANALYSIS COULD INDICATE THAT THE SECOND ORDER RESPONSE FUNCTIONS ARE VERY GOOD PREDICTORS OF EFFECTIVENESS. IN THIS CASE THE BASIC EXPERIMENTAL DESIGN WOULD BE USED FOR THE REMAINING SITUATIONS AND, IN ALL LIKELIHOOD, THE STUDY WOULD BE COMPLETED WELL UNDER BUDGET.

CASE 3. STATISTICAL ANALYSIS COULD INDICATE THAT, WHILE EFFECTIVENESS IS CLEARLY LINKED TO THE CHARACTERISTICS BEING CONSIDERED, A SECOND-ORDER PREDICTION EQUATION DOES NOT FOLLOW ANY PREDICTION. IN THIS CASE, A REVIEW OF DATA PLOTS MUST BE CONDUCTED TO ESTABLISH SOME DIFFERENT FUNCTIONAL FORM. IF THIS CASE SHOULD CONSISTENTLY OCCUR, IT IS LIKELY THAT TIME WILL PERMIT INVESTIGATION OF ONLY A FEW SITUATIONS.

CASE 4. STATISTICAL ANALYSIS COULD INDICATE THAT THE SECOND-ORDER EQUATION OFFERS GOOD PREDICTION OF EFFECTIVENESS BUT CAN BE IMPROVED. IN THIS CASE THE BASIC EXPERIMENTAL DESIGN SHOULD BE COMPLETED FOR ALL SITUATIONS AND ADDITIONAL DATA POINTS ADDED TO ALLOW FITTING TO A HIGHER DEGREE POLYNOMIAL. ALL SITUATIONS CAN PROBABLY BE TREATED IN THIS CASE.

THERE EXISTS A FIFTH CASE, IN WHICH THE RESULTS OF THE BASIC EXPERIMENT ARE DIVERSE FOR THE SITUATIONS CONSIDERED. SHOULD THIS OCCUR, APPROPRIATE FOLLOW-ON ACTIVITY WOULD DIFFER FOR EACH OF THE COMBAT SITUATIONS. FURTHER EXPERIMENTATION WOULD BE LARGELY A MATTER OF THE ANALYST'S JUDGMENT, BASED ON HIS APPRECIATION OF THE DATA AT HAND.

(SLIDE 49 OFF)

#### ANALYSIS AND RESULTS STAGE

THE FINAL SIMULATION STAGE IS ANALYSIS. AS WE HAVE SAID, REGRESSION TECHNIQUES ARE TO BE USED IN ANALYZING THE SIMULATION RESULTS. THE MECHANICAL PROCESS OF CONDUCTING A REGRESSION ANALYSIS OF A BODY OF DATA IS WELL KNOWN IN THE TECHNICAL COMMUNITY AND WE WILL NOT ATTEMPT A DETAILED DESCRIPTION OF THE PROCESS IN THIS PRESENTATION.

THE BASIC OUTCOME OF SIMULATION ANALYSIS WILL BE AN EQUATION OR SET OF EQUATIONS FOR EACH OF THE COMBAT SITUATIONS CONSIDERED. THESE EQUATIONS WILL PERMIT A PREDICTION OF COMBAT EFFECTIVENESS AS A FUNCTION OF WEAPON CHARACTERISTICS INsofar AS EFFECTIVENESS IS PREDICTABLE IN TERMS OF SMALL ARMS CHARACTERISTICS. THERE, HOWEVER, ARE LIMITATIONS TO THIS. THE ACTUAL EFFECTIVENESS OF ANY WEAPON DEPENDS MORE ON HOW AND IN WHAT SITUATIONS THE WEAPON IS USED THAN ON THE CHARACTERISTICS OF THE WEAPON. THE PROBLEM OF ASARS CENTERS UPON THE WEAPON ITSELF, AND THE ASARS II METHODOLOGY CONCENTRATES ON ATTEMPTING TO PREDICT EFFECTIVENESS IN TERMS OF WEAPON CHARACTERISTICS WHICH CAN, TO A DEGREE, BE CONTROLLED BY THE WEAPON DEVELOPER. THERE, HOWEVER, IS A DISTINCT POSSIBILITY THERE EXISTS A BROAD RANGE OF WEAPONS CHARACTERISTICS OVER WHICH PREDICTION IS EITHER IMPOSSIBLE OR OVER WHICH PREDICTION LEADS TO NO PREFERENCE.

PRIOR TO DISCUSSING SYNTHESIS, I WOULD LIKE TO BRIEFLY DISCUSS THE OTHER PROCEDURE OF ASARS II - THAT OF JUDGMENTAL STUDIES.

### JUDGMENTAL STUDIES

THE INFANTRY AGENCY HAS IDENTIFIED THE REQUIREMENT FOR CONDUCTING A JUDGMENTAL STUDY ON THE "ROLE AND EFFECTIVENESS OF SMALL ARMS AS RELATED TO INFANTRY BATTALION SUPPORTING WEAPONS". COMPLETION OF THIS STUDY IS NECESSARY TO SATISFY TASK 3 OF ASARS II.

(SLIDE 50 ON)

#### TASK III OF ASARS II

"DETERMINE THE ROLE AND EFFECTIVENESS OF SMALL ARMS AS THEY RELATE TO INFANTRY BATTALION SUPPORTING WEAPONS IN COMBAT."

(SLIDE 50 OFF)

INPUT TO THIS JUDGMENTAL STUDY SHOULD BE AVAILABLE BOTH FROM SIMULATION AND THE CASUALTY DATA ANNEX. THIS INPUT, OF COURSE, IS IN TERMS OF CASUALTY PRODUCTION, WHICH IS NOT THE ONLY PERTINENT FACTOR. SIMULATION WILL REVEAL OTHER INFORMATION FROM THE SCENARIOS, TERRAIN, ENVIRONMENT, AND THE THREAT. ALL SUPPORTING WEAPONS WILL BE PLAYED AS REALISTICALLY AS POSSIBLE, BUT THE RESULTS MUST BE EVALUATED BY EXPERIENCED MILITARY PERSONNEL. THERE ARE MANY ASPECTS OF TACTICS AND DOCTRINE WHICH MAY NOT BE ADEQUATELY ACCOUNTED FOR IN SIMULATION. THESE ASPECTS MUST APPLIED BY THE MILITARY. THIS APPLICATION AND ANALYSIS CAN BEST BE ACCOMPLISHED IN THE FORM OF A JUDGMENTAL STUDY.

WE ALSO VISUALIZE THAT A SIGNIFICANT AMOUNT OF FALL-OUT DATA FROM ASARS WILL BE AVAILABLE TO OTHER AGENCIES AND COMMANDS FOR USE WITHIN THEIR STUDIES AND EXPERIMENTATIONS WHICH WILL BE REQUIRED TO SATISFY THE OTHER ANSWERS TO SUPPORT THE PREPARATION OF MATERIEL REQUIREMENT DOCUMENTS.

## SYNTHESIS

UPON COMPLETION OF THE SIMULATION ANALYSIS AND THE JUDGMENTAL STUDIES, ASARS II WILL BECOME A SYNTHESIS PROBLEM. THE APPROACH TO BE FOLLOWED FOR ASARS II SYNTHESIS WILL BE TO TAKE THE CONTRACTOR'S ANALYSIS OF THE SIMULATION RESULTS, WHICH MUST BE PROVIDED IN A SUITABLE AND MEANINGFUL FORMAT, AS A STARTING POINT, AND THEN THROUGH A SERIES OF STEPS WHICH ADD VARIOUS RESULTS AND EVALUATIONS TO THIS BASIS, ARRIVE AT CHARACTERISTICS CONSIDERED ESSENTIAL FOR THE SMALL ARMS REQUIREMENT. THE NEXT SLIDE DISPLAYS OUR CONCEPT OF THE SYNTHESIS PROCESS. YOU WILL NOTE THAT ONLY A PORTION OF THIS SYNTHESIS ACTUALLY FALLS WITHIN ASARS II.

(SLIDE 51 ON)

THE FIRST STEP OF THE SYNTHESIS WILL BE INTERPRETATION OF SIMULATION RESULTS. THE SIMULATION ANALYSIS WILL HAVE PROVIDED, FOR EACH OF THE COMBAT SITUATIONS, A PREDICTION EQUATION. THESE EQUATIONS WILL PERMIT THE PREDICTION OF COMBAT EFFECTIVENESS IN TERMS OF THE WEAPONS PERFORMANCE CHARACTERISTICS. BASED ON THESE EQUATIONS, AND THE RESPONSE SURFACES DEFINED BY THE EQUATIONS, THE SYNTHESIS TEAM WILL MAKE TWO TENTATIVE DECISIONS. FIRST, THE RANGE OF EACH PERFORMANCE CHARACTERISTIC WILL BE DIVIDED INTO THREE REGIONS. THESE WILL BE TERMED UNACCEPTABLE, ACCEPTABLE, AND DESIRED REGIONS OF THE POSSIBLE RANGE. SECONDLY, A TENTATIVE RANKING OF THE PERFORMANCE CHARACTERISTICS WILL BE DEVELOPED. THIS IS TO BE ACCOMPLISHED PRIMARILY THROUGH INVESTIGATIONS OF THE RATE OF CHANGE OF EFFECTIVENESS AS THE CHARACTERISTICS VARY OR, IN SOMEWHAT MORE TECHNICAL TERMS, THROUGH CONSIDERATION OF THE DERIVATIVES OF THE RESPONSE FUNCTION WITH RESPECT TO THE CHARACTERISTICS. ACCOMPLISHMENT OF THIS STEP WILL ALSO REQUIRE THE IDENTIFICATION OF A MINIMUM ACCEPTABLE LEVEL OF EFFECTIVENESS.

THE SECOND STEP OF THE SYNTHESIS, WHICH WILL BE SOMEWHAT LIMITED, WILL BE THE ADDITION OF SELECTED PHYSICAL CHARACTERISTICS TO THE LIST OF PERFORMANCE CHARACTERISTICS. IT IS EXPECTED THAT THE BASIC PHYSICAL CHARACTERISTICS TO ENTER AT THIS POINT WILL BE WEAPON SIZE, WEAPON WEIGHT, AND ASSOCIATED SUSTAINABILITY REQUIREMENTS AS DEVELOPED IN OTHER STUDIES. WITHIN THIS STEP, PERFORMANCE CHARACTERISTICS RANKING AND RANGES WILL BE REVIEWED IN LIGHT OF ANY LIMITATIONS IMPLIED BY THE PHYSICAL CHARACTERISTIC REQUIREMENTS AND ADJUSTED AS REQUIRED. THE PHYSICAL CHARACTERISTICS WILL THEN BE ADDED TO THE LIST OF WEAPON CHARACTERISTICS. AT THIS POINT, ASARS II WILL TERMINATE. HOWEVER, YOU WILL RECALL THAT THE OVERALL PURPOSE OF ASARS IS TO ESTABLISH MISSION AND PERFORMANCE ENVELOPES, WHICH IN CONJUNCTION WITH OTHER STUDIES OF THE ARSAP WILL PERMIT THE DEVELOPMENT OF THE MOST COMBAT EFFECTIVE SYSTEM IN THE 1980 - 1985 TIME PERIOD. AT THIS POINT IN TIME THE MISSION AND PERFORMANCE ENVELOPES, OR CONCEPT FORMULATION, WILL HAVE BEEN ACCOMPLISHED. BUT, TO ACCOMPLISH THE ACTUAL DEVELOPMENT OF A NEW FAMILY OF SMALL ARMS THE SYNTHESIS MUST GO FURTHER. THE REMAINING TWO STEPS DISPLAYED HERE, THOUGH NOT A PART OF ASARS II, ARE OUR CONCEPT OF HOW THE SYNTHESIS MIGHT CONTINUE.

(FLIP ON)

THE THIRD STEP OF THE SYNTHESIS IS ONE OF COMPROMISE AND CONSOLIDATION. THE FIRST TWO STEPS WILL HAVE IDENTIFIED BASIC REQUIREMENTS FOR EACH OF THE COMBAT SITUATIONS UNDER CONSIDERATION. THESE MUST BE BROUGHT TOGETHER TO FORM REQUIREMENTS FOR ARMY-WIDE WEAPONS SYSTEMS. THUS THE BASIC PROBLEM WILL BE TO IDENTIFY WHAT IS BEING GIVEN AWAY IN ONE SITUATION IF REQUIREMENTS ARE TAILORED FOR A DIFFERENT SITUATION AND TO REACH A COMPROMISE DECISION. IT IS EXPECTED THAT THE JUDGMENTAL STUDY OF THE ROLE AND EFFECTIVENESS OF SMALL ARMS AS COMPARED TO SUPPORTING WEAPONS WILL SHED SOME LIGHT ON HOW MUCH CAN BE "GIVEN

AWAY" IN A PARTICULAR SITUATION. ESTABLISHING THE EXACT PROCEDURES TO BE FOLLOWED IN THIS WILL BE DIFFICULT, SINCE THIS STEP IS THE MOST COMPLICATED STEP OF THE SYNTHESIS.

THE FOURTH STEP OF THE SYNTHESIS IS A PROCESS OF FILLING IN THE REMAINING GAPS. THE THIRD STEP WILL HAVE PRODUCED PREFERRED CHARACTERISTICS. IN THE FOURTH STEP, ADDITIONAL ITEMS WILL BE ADDED TO THE REQUIREMENT STATEMENT, BASED ON OTHER STUDY RESULTS. THESE WILL BE FACTORS SUCH AS NON-INFANTRY APPLICATIONS, HUMAN ENGINEERING, TRAINING, RELIABILITY AND MAINTAINABILITY. IT IS NOT EXPECTED THAT ANY TRADE-OFFS WILL BE REQUIRED AT THIS STAGE OF THE SYNTHESIS. IT CAN BE SEEN THAT STEP 2 MAY HAVE TO BE REPEATED SEVERAL TIMES.

RESULTS OF THE SYNTHESIS WILL THEN PROVIDE THE BASIS FOR ANY NEEDED MATERIAL REQUIREMENT STATEMENTS.

(SLIDE 51 OFF)

THIS CONCLUDES MY PORTION OF THE BRIEFING. I WILL BE FOLLOWED BY COLONEL PARKER WITH THE SUMMARY.

F

FB<sup>C</sup><sub>10</sub> MAY 63 208F

## SUMMARY

GENTLEMEN, THAT CONCLUDES THE FORMAL PRESENTATION OF THE DETAILED EXPLANATION OF ASARS I. THIS INFORMATION, PLUS THAT INDICATED AS STILL IN THE PREPARATION PHASE WILL BE PLACED IN A FINAL REPORT AND FORWARDED THRU CHANNELS BY 30 JUNE 1970. YOU HAVE SEEN THE FORMAT AS FAR AS THE ANNEXES GO. WE DO NOT PLAN A VOLUMINOUS FINAL REPORT BECAUSE THE ANSWERS FOR THE ENTIRE STUDY HAVE NOT YET BEEN OBTAINED. RATHER, WE PLAN TO FORWARD THE INFORMATION, WITH A REQUEST FOR APPROVAL OR NOTATION AS APPROPRIATE. UPON RECEIPT OF THE APPROVAL, WE CAN COMMENCE WITH ASARS II.

AS WE HAVE POINTED OUT AS WE WENT ALONG, THERE ARE STILL DATA GAPS IN EXISTENCE. AMONG THESE, THE MAJOR ONES ARE TARGET ACQUISITION AND DETECTION; SUPPRESSION; FREQUENCY OF SMALL UNIT ENGAGEMENTS BY TYPE ACTION, SUCH AS ATTACK, DEFENSE AND WITHDRAWAL; AND TARGET EXPOSURE TIMES. OTHER AREAS THAT BEAR FURTHER INVESTIGATION ARE INDICATED WITHIN THE VARIOUS ANNEXES. WE DO NOT FEEL THAT THE LACK OF THESE DATA WILL PREVENT THE SUCCESSFUL CONCLUSION OF ASARS II - THAT OF PROVIDING INFORMATION ON WEAPONS CHARACTERISTICS THAT CAN BE USED AS A BASIS FOR MATERIEL REQUIREMENT DOCUMENTS.

BEFORE WE TURN TO THE DISCUSSION PHASE, LET'S LOOK AT THE ASSISTANCE FROM OUTSIDE THE AGENCY THAT WILL BE REQUIRED TO COMPLETE ASARS II. THE EFFORT REQUIRED IS THAT CONTAINED IN THE REQUEST FOR CONTRACT SERVICE FOR ASARS II THAT WAS SUBMITTED BY THE INFANTRY AGENCY IN JANUARY OF THIS YEAR. THESE TASKS ARE SHOWN ON THIS NEXT SLIDE.

(SLIDE 52 ON)

(SLIDE 52 OFF)

AFTER MUCH STUDY, WE HAVE ESTIMATED THAT THE CONDUCT OF THESE TASKS WILL REQUIRE 96 MAN MONTHS OF OUTSIDE ASSISTANCE IN FY 71 AND 111 MAN MONTHS IN FY 72. THIS IS BROKEN DOWN AS INDICATED ON THIS SLIDE.

(SLIDE 53 ON)

THIS IS FY 71

(SLIDE 53 OFF)

(SLIDE 53a ON)

WE FEEL THAT THIS IS THE MINIMUM EFFORT THAT CAN GO INTO THE STUDY AND STILL ARRIVE AT A SUCCESSFUL CONCLUSION. THIS ESTIMATE DOES CONSIDER THE REDUCED SCOPE WE HAVE CONSIDERED.

(SLIDE 53a OFF)

G

FB<sup>C</sup><sub>10</sub> MAY 63 208

## **ASARS**

THE OVERALL PURPOSE OF ASARS IS TO ESTABLISH  
MISSION AND PERFORMANCE ENVELOPES FOR SMALL  
ARMS, WHICH, IN CONJUNCTION WITH OTHER STUDIES  
OF THE ARMY SMALL ARMS PROGRAM WILL PERMIT  
THE DEVELOPMENT OF THE MOST COMBAT EFFECTIVE  
SMALL ARMS SYSTEM IN THE 1980-1985 TIME PERIOD.

## **ASARS**

**THE OBJECTIVE OF ASARS I IS TO ESTABLISH A VALID SMALL  
ARMS REQUIREMENTS DATA BASE IN THE 1980-1985 TIME  
FRAME AND CONCURRENTLY DEVELOP EFFECTIVENESS MEASURES  
WHICH WILL PERMIT THE DETERMINATION OF THE BEST SMALL  
ARMS SYSTEM TO SATISFY THESE REQUIREMENTS.**

THE OBJECTIVE OF ASARS II IS, AS A BASIS FOR A SERIES OF QMR's, TO DETERMINE THE WEAPON CHARACTERISTICS NEEDED TO SATISFY THE SMALL ARMS SYSTEM REQUIREMENTS IN ARMY-85 AND ESTABLISH TRADE-OFFS FOR EACH WEAPON SYSTEM CHARACTERISTIC IN TERMS OF COMBAT EFFECTIVENESS.



## **ASARS II**

### **TASK VI**

**FROM THE RESULTS OF THE VARIOUS ANALYSES  
CONDUCTED UNDER PRECEDING OBJECTIVES, DETERMINE  
THOSE WEAPONS CHARACTERISTICS CONSIDERED ESSENTIAL  
TO SATISFY THE SMALL ARMS REQUIREMENTS. SUCH  
CHARACTERISTICS WILL BE STATED IN SUFFICIENT DETAIL  
TO PERMIT PREPARATION OF QMR IN ACCORDANCE WITH  
APPENDIX D, AR 71-1.**

## **ASARS I TASKS**

- MEASURES OF EFFECTIVENESS
- WEAPON CHARACTERISTICS
- CASUALTY DATA
- ENVIRONMENT VS TARGET DISTRIBUTIONS
- TARGET DISTRIBUTIONS AND ENGAGEMENT
- STANO CAPABILITIES
- ROLE OF SMALL ARMS
- DOCTRINAL REQUIREMENTS FOR SMALL ARMS
- HUMAN FACTORS
- MISSION FREQUENCY

- CDCIA TASKS

• CARO TASKS

•• CDCIA/CARO TASKS

## **OTHER ASARS I TASKS**

### **\* ASARS II METHODOLOGY**

#### **\*\* MONITORING OTHER ARSAP TASKS**

#### **\*\* RECOMMEND SIMULATION MODEL FOR ASARS II**

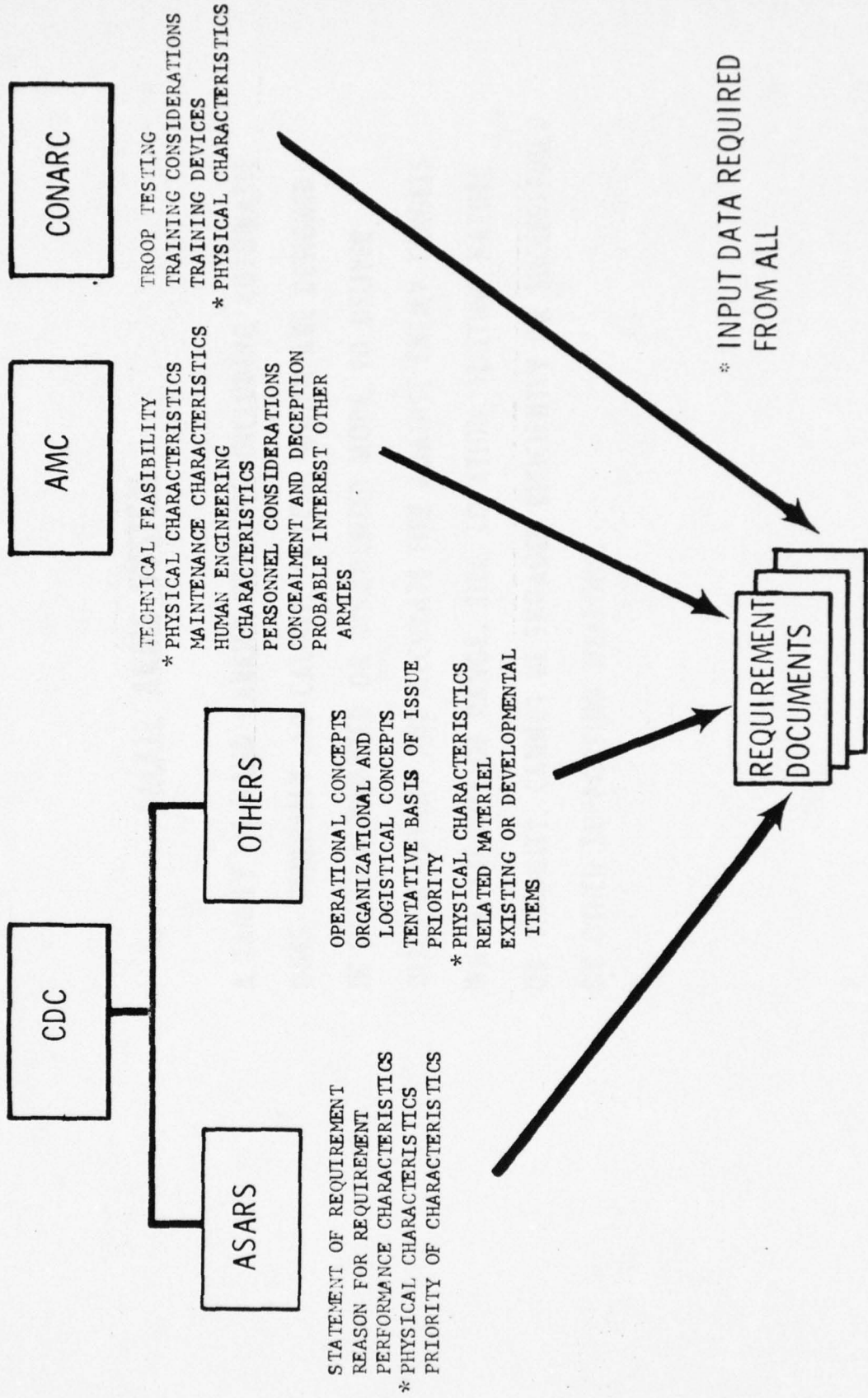
### **\* CARO TASKS**

#### **\*\* JOINT TASKS**

# **ASARS I REPORT**

**A-STUDY DIRECTIVE**  
**B-THREAT**  
**C-TARGET DISTRIBUTIONS**  
**D-ROLE OF SMALL ARMS**  
**E-HUMAN FACTORS**  
**F-INFANTRY BN TARGET  
ACQUISITION CAPABILITIES**  
**G-CASUALTY DATA**  
**H-DOCTRINAL REQUIREMENTS**  
**I-MISSION FREQUENCY**  
**J-ENVIRONMENTAL EFFECTS**  
**K-ASARS II METHODOLOGY**  
**L-BIBLIOGRAPHY**

# INPUT FOR REQUIREMENT DOCUMENTS



## **SMALL ARMS SYSTEM**

**A FAMILY OF HAND CARRIED WEAPONS, INCLUDING AUTOMATIC ONES, GENERALLY .60 CALIBER OR LESS, WHICH ARE DESIGNED, IN EITHER A MOUNTED OR DISMOUNTED MODE, TO DELIVER DISCRIMINATORY AND ACCURATE FIRE AGAINST ENEMY TARGETS WHICH, BECAUSE OF RANGE, SIZE, LOCATION, FLEETING NATURE OR VISIBILITY, CANNOT BE ENGAGED EFFICIENTLY OR SUCCESSFULLY BY OTHER SUPPORTING WEAPONS.**



## SCOPE OF ASARS II SIMULATION

<u>INTENSITY OF CONFLICT</u>	<u>TYPE OF ACTION</u>	<u>TYPE OF INFANTRY</u>	<u>GEOGRAPHIC AREA</u>
LOW	ATTACK DEFENSE	{ INFANTRY AIRMObILE }	SOUTHEAST ASIA
MID	ATTACK DEFENSE	{ INFANTRY MECHANIZED }	KOREA MIDDLE EAST
HIGH	ATTACK DEFENSE MEET. ENGAGE.	MECHANIZED	WESTERN EUROPE



## SCOPE OF ASARS II SIMULATION

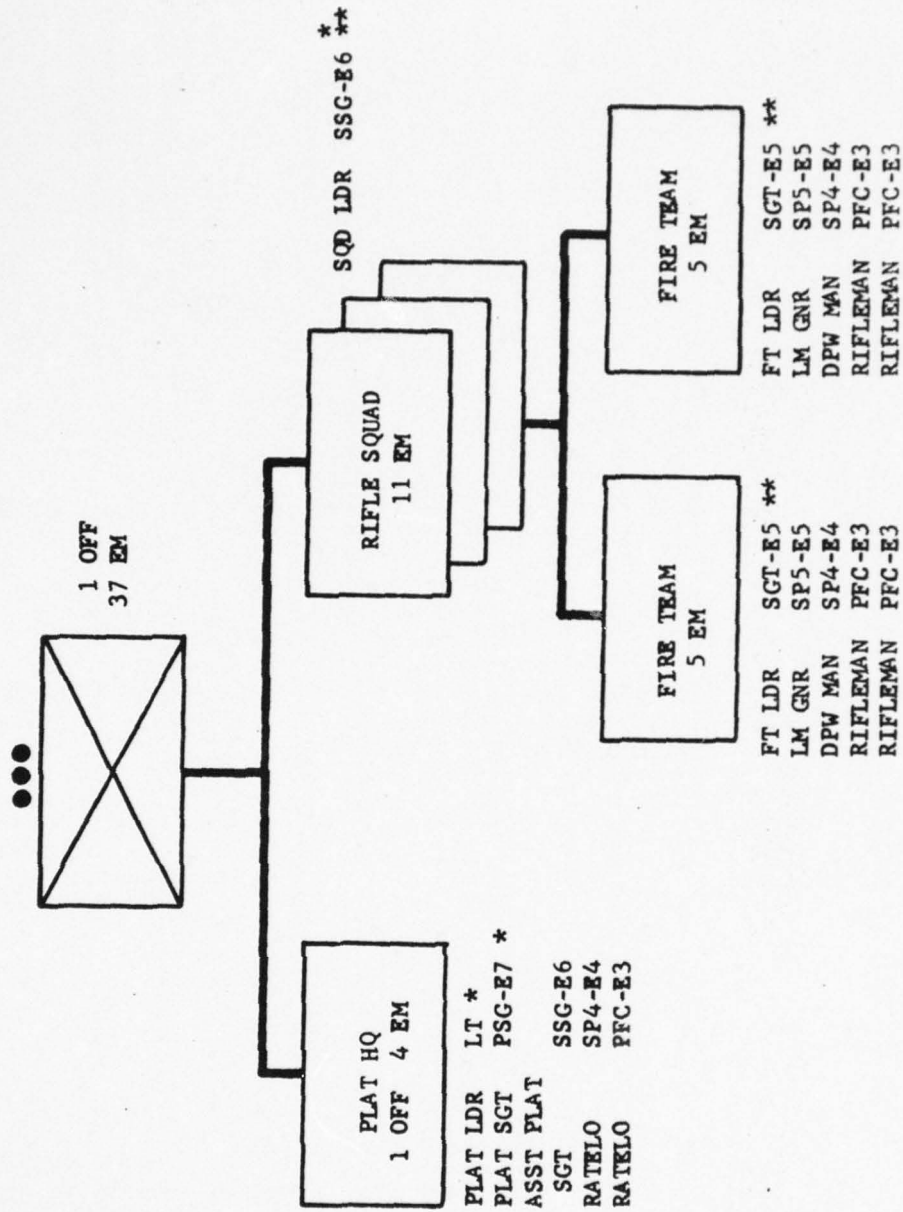


<u>INTENSITY OF CONFLICT</u>	<u>TYPE OF ACTION</u>	<u>TYPE OF INFANTRY</u>	<u>GEOGRAPHIC AREA</u>
<del>LOW</del> MID	ATTACK <del>DEFENSE</del>	<del>INFANTRY</del> AIRMObILE	SOUTHEAST ASIA
MID	ATTACK DEFENSE	<del>INFANTRY</del> <del>MECHANIZED</del>	KOREA <del>MIDDLE EAST</del>
<del>HIGH</del> MID	ATTACK DEFENSE <del>MEET. ENGAGE.</del>	MECHANIZED	WESTERN EUROPE

FOR OFFICIAL USE ONLY

IRUS - 75

RECOMMENDED PLATOON



FOR OFFICIAL USE ONLY

IRUS recommended organization infantry, airmobile, airborne and aero rifle units.

## **TASK**

**USING APPROVED THREAT STUDIES, DETERMINE  
THE ENEMY TARGET DISTRIBUTIONS BY RANGE , TYPE,  
ACTIVITY AND EXPOSURES THAT MUST BE DEFEATED  
IN THE ATTACK, DEFENSE, AND MEETING ENGAGEMENTS.**

**FOR OFFICIAL USE ONLY**

**TARGET SITUATIONS**

<b>INTENSITY OF CONFLICT</b>	<b>TYPE OF ACTION</b>	<b>GEOGRAPHIC AREA</b>
<b>LOW</b>	<b>ATTACK DEFENSE</b>	<b>THAILAND NORTH WEST OF KORAT</b>
<b>MID</b>	<b>MOUNTED ATTACK DISMOUNTED ATTACK DEFENSE</b>	<b>IRAN ESFAHAN-200MILES SOUTH OF TEHRAN</b>
<b>MID</b>	<b>DISMOUNTED ATTACK DEFENSE</b>	<b>KOREA SOUTH OF CHORWON</b>
<b>HIGH</b>	<b>MOUNTED ATTACK DISMOUNTED ATTACK DEFENSE</b>	<b>GERMANY BETWEEN FULDA AND FRANKFURT</b>

**FOR OFFICIAL USE ONLY**

## **TASK**

**DETERMINE THE ROLE OF SMALL ARMS IN HIGH,  
MID AND LOW INTENSITY CONFLICT.**

## **ASARS**

### **ROLE OF SMALL ARMS**

- 1. TO PROVIDE GROUND FORCES WITH FIREPOWER FOR CLOSING WITH THE ENEMY IN ORDER TO DESTROY HIM OR HIS WILL TO FIGHT, OR TO REPEL HIS ASSAULT BY FIRE, CLOSE COMBAT AND COUNTERATTACK.**
- 2. TO PROVIDE A WEAPON FOR THE INDIVIDUAL(S) RESPONSIBLE FOR SECURITY OF MAN OR MATERIEL, IN PEACE OR WAR, AND IN THE COMBAT ZONE OR THE NONCOMBAT ZONE.**
- 3. TO PROVIDE PROTECTION FOR THE INDIVIDUAL(S) IN NONSECURE AREAS.**



## **ASARS I OBJECTIVE**



### **SUB-TASK XI**

**ASSEMBLE DATA ON HUMAN FACTORS  
CONSIDERATION FOR SMALL ARMS EMPLOYMENT  
SUCH AS SUPPRESSION, VULNERABILITY, TARGET  
ACQUISITION AND ENGAGEMENT TECHNIQUES.**



## **ASARS I OBJECTIVE**



### **SUB-TASK VII**

**IDENTIFY AND LIST THE CAPABILITIES OF SURVEILLANCE, TARGET ACQUISITION AND NIGHT OBSERVATION EQUIPMENT (STANO) LIKELY TO BE EMPLOYED BY AN INFANTRY BATTALION IN THE 1980- 1985 TIME PERIOD.**

### **SUB-TASK VIII**

**USING SURVEILLANCE, TARGET ACQUISITION, AND NIGHT OBSERVATION EQUIPMENT LIKELY TO BE EMPLOYED BY THE INFANTRY BATTALION IN THE 1980- 1985 TIME PERIOD, DETERMINE THE ACQUISITION CAPABILITIES AGAINST THE ENEMY TARGET DISTRIBUTION IDENTIFIED IN SUB-TASK VI.**



## **ASARS I OBJECTIVE**



### **SUB-TASK IV**

**ASSEMBLE FRIENDLY AND ENEMY CASUALTY  
DATA AND DETERMINE THE CONTRIBUTION OF SMALL  
ARMS TO CASUALTY PRODUCTION AND COMBAT  
EFFECTIVENESS.**



## **ASARS I OBJECTIVE**



### **SUB-TASK XII**

**DETERMINE THE DOCTRINAL REQUIREMENTS FOR  
SMALL ARMS FOR THE INFANTRY BATTALION AND BELOW  
IN THE ATTACK, DEFENSE AND MEETING ENGAGEMENTS IN  
THE SELECTED GEOGRAPHICAL AREAS OF THE WORLD UNDER  
ALL ENVIRONMENTAL CONDITIONS DURING THE 1980-1985  
TIME PERIOD.**

AREA OF OPERATIONS

NOT INCLUDED



## **INFANTRY DOCTRINAL REQUIREMENTS FOR SMALL ARMS**

1. Infantry doctrine of the 1980-1985 time frame will require a small arms system that is man-portable and capable of delivering an accurate volume of fire for sustained periods of time in offensive and defensive action by troops operating in either a mounted or dismounted role to include firing from the Mechanized Infantry Combat Vehicle (MICV)
2. The small arms system must operate with near daylight efficiency at night to allow fires to fully exploit the capabilities of night vision devices, electronic sensor and target acquisition equipment organic to the rifle company.
3. The small arms system must afford the user maximum opportunity to engage targets of opportunity and must be capable of being rapidly placed into action and shifted from one target to another.



## **INFANTRY DOCTRINAL REQUIREMENTS FOR SMALL ARMS**

**(cont)**

4. The small arms weapons system must be capable of being carried into action by parachutists.
5. The small arms weapons system utilized by the infantry in the defense must be capable of delivering effective fire a minimum distance of 250 meters in order to cover unoccupied gaps between units. This system must further provide a means for units to establish a barrier of interlocking bands of grazing fire across forward defensive areas in front of occupied and unoccupied areas for a minimum distance of 650 meters.
6. The small arms system must have the capability of delivering both point and area fire.

## **TASK**

**CONSIDER FREQUENCY OF ATTACK, DEFENSE, AND MEETING ENGAGEMENTS WITHIN EACH CONFLICT INTENSITY IN SUFFICIENT DETAIL TO PERMIT EVALUATION OF EFFECT OF RELATIVE FREQUENCY AND DURATION OF THESE TYPE ACTIONS UPON SMALL ARMS SYSTEMS REQUIREMENTS.**

## **TASK**

**DETERMINE THE EFFECT OF TERRAIN AND ENVIRONMENT  
ON TARGET DISTRIBUTIONS IN THE SELECTED GEOGRAPHIC  
AREAS.**



## **GEOGRAPHIC AREAS**

**WEST GERMANY**

**IRAN**

**THAILAND**

**SOUTH KOREA**



# **MAJOR COMPONENTS**

**MACRO—TERRAIN**

**MICRO—TERRAIN**

**VEGETATION**

## **TASK**

**PREPARE A METHODOLOGY FOR THE CONDUCT OF  
ASARS II IN SUFFICIENT DETAIL TO INSURE THAT  
THE OUTPUT OF ASARS I WILL CONTRIBUTE TO  
THE EFFICIENT ACCOMPLISHMENT OF THE ASARS II OBJECTIVES.**

## **TASK**

**RECOMMEND A SIMULATION MODEL TO BE USED  
IN ACCOMPLISHING THE OBJECTIVES OF ASARS II.**

# **TASK**

**ESTABLISH THE MEASURES OF AND THE  
METHODS FOR EVALUATING SMALL ARMS EFFECTIVENESS.**

## **TASK**

**DETERMINE, DEFINE AND ESTABLISH MATHEMATICAL  
FUNCTIONAL RELATIONSHIPS AMONG MEASURABLE SMALL  
ARMS CHARACTERISTICS.**

## **ASARS II TASKS**

**MONITOR DATA FROM OTHER ARSAP TASKS.**

**MODIFY AND USE A SIMULATION MODEL IN ACCOMPLISHING ASARS II OBJECTIVES USING ASARS I DATA.**

**DETERMINE ROLE AND EFFECTIVENESS OF SMALL ARMS AS THEY RELATE TO INF BN SUPPORTING WPNS IN COMBAT.**

**DETERMINE RELATIVE CONTRIBUTION OF VARIOUS SMALL ARMS WPNS CHARACTERISTICS TO OVERALL COMBAT EFFECTIVENESS FOR EACH CONFLICT INTENSITY IN ATK, DEF, AND MEETING ENGAGEMENT.**

**DETERMINE RELATIVE COMBAT EFFECTIVENESS OF VARIOUS SMALL ARMS WPNS MIXES FOR GEOGRAPHIC, WARFARE INTENSITY, AND MISSION COMBINATIONS REQUIRED.**

**FROM RESULTS OF ANALYSIS CONDUCTED, DETERMINE WPNS CHARACTERISTICS CONSIDERED ESSENTIAL TO SATISFY SMALL ARMS REQUIREMENTS.**



## DEFINITE SIMULATION OUTPUT REQUIREMENTS

- 1.— RED CASUALTIES (TOTAL)
- 2.— BLUE CASUALTIES (TOTAL)
- 3.— RED EQUIPMENT LOSSES (TOTAL BY TYPE)
- 4.— BLUE EQUIPMENT LOSSES (TOTAL BY TYPE)
- 5.— RED ROUNDS EXPENDED (TOTAL BY TYPE)
- 6.— BLUE ROUNDS EXPENDED (TOTAL BY TYPE)
- 7.— RED TOTAL TIME SUPPRESSED (BY TARGET TYPE)
- 8.— BLUE TOTAL TIME SUPPRESSED (BY TARGET TYPE)
- 9.— BATTLE TIME (TOTAL DURATION)



## **DESIRABLE SIMULATION OUTPUT REQUIREMENTS**

- 1.— REDUCTION IN FIREPOWER (IF DEFINABLE)
- 2.— EACH OF THE DEFINITE REQUIREMENTS CONCERNING CASUALTIES, EQUIPMENT LOSSES, ROUNDS EXPENDED, AND SUPPRESSION IN RUNNING TOTALS BY TIME.
- 3.— MEAN TIME EACH TARGET TYPE IS PINPOINTED (EXPOSED AND VULNERABLE TO AIMED FIRE)
- 4.— TOTAL HITS PER WEAPON/TARGET COMBINATION.
- 5.— MEAN TOTAL TIME EACH WEAPON TYPE IS IN PROCESS OF DELIVERING AIMED FIRE.
- 6.— MEAN TOTAL TIME EACH WEAPON TYPE IS IN PROCESS OF DELIVERING UNAIMED FIRE.



## **ASARS II SIMULATION REQUIREMENTS**

1. ESTABLISH THE PARAMETERS AND CHARACTERISTICS OF COMBAT WHICH ARE TO BE SIMULATED IN ASARS II.
2. IDENTIFY THE TREATMENT OF THESE PARAMETERS AND CHARACTERISTICS.
3. IDENTIFY THE GENERAL INPUTS REQUIRED FOR EACH PARAMETER AND SIMULATION CHARACTERISTIC.
4. IDENTIFY THE OUTPUTS REQUIRED.



## **ASARS II TASK IV**

**DETERMINE THE RELATIVE CONTRIBUTION OF  
VARIOUS SMALL ARMS WEAPONS CHARACTERISTICS  
TO OVERALL COMBAT EFFECTIVENESS FOR EACH  
CONFLICT INTENSITY IN ATTACK, DEFENSE AND MEETING  
ENGAGEMENTS IN THE VARIOUS AREAS CONCERNED.**



## **ASARS II SIMULATION STAGES**

- 1.— PREPARATION**
- 2.— PRELIMINARY EXPERIMENT**
- 3.— BASIC EXPERIMENT**
- 4.— FOLLOW-ON EXPERIMENT**
- 5.— SIMULATION ANALYSIS**



REQUIRED SIMULATION DATA CATEGORIES

- 1 - TERRAIN AND VEGETATION DATA
- 2 - SCENARIO AND GENERAL DATA
- 3 - EQUIPMENT DATA

## SCENARIO AND GENERAL DATA

ENEMY TROOP DISPOSITIONS AND SCHEME OF MANEUVER [THREAT ANNEX, TARGET DISTRIBUTION ANNEX, TARGET ARRAYS APPENDIX]

FRIENDLY TROOP DISPOSITION AND SCHEME OF MANEUVER [ROLE OF SMALL ARMS ANNEX, DOCTRINAL REQUIREMENTS ANNEX, MILITARY JUDGMENT (IA)]

SUPPORT FIRE PLAN [MILITARY JUDGMENT (IA)]

TERMINATION OF DEFEAT CRITERIA [MILITARY JUDGMENT (IA)]

TARGET DESCRIPTION AND PRIORITIES [THREAT ANNEX, ORGANIZATIONAL TABLES, MILITARY JUDGMENT (IA)]

DETECTION PARAMETERS [MILITARY JUDGMENT (IA)]

MOVEMENT RATE [MILITARY JUDGMENT (IA)]

VULNERABILITY INDEXES [MILITARY JUDGMENT (IA)]

SUPPRESSION THRESHOLDS AND DURATION [CDCEC, MILITARY JUDGMENT (IA)]

AMMUNITION EXPENDITURE INSTRUCTIONS [MILITARY JUDGMENT (IA)]



## WEAPON CHARACTERISTICS



### PERFORMANCE

· INCAPACITATION PROBABILITY ( $P_K$ )

· ACCURACY ( $P_H$ )

· LETHALITY ( $P_{HK}$ )

· LETHAL AREA

· RATE OF FIRE

### PHYSICAL

· MUZZLE VELOCITY

· WEAPON RECOIL

· BALLISTIC ERROR

· ROUNDS PER BURST

· WEAPON WEIGHT

· PROJECTILE WEIGHT

## **WEAPON CATEGORIES**

- 1. SINGLE PROJECTILE CARTRIDGE, SEMI-AUTOMATIC FIRE.**
- 2. SINGLE PROJECTILE CARTRIDGE, AUTOMATIC BURST FIRE.**
- 3. MULTIPLE PROJECTILE CARTRIDGE, SEMI-AUTOMATIC FIRE.**
- 4. AIMED MACHINEGUN FIRE AGAINST AN AREA TARGET.**
- 5. AIMED FIRE OF A FRAGMENTING PROJECTILE AGAINST AN AREA TARGET.**

PERFORMANCE CHARACTERISTICS RELATABLE TO EFFECTIVENESS

	ABILITY TO HIT ( $P_H$ )	ABILITY TO INCAPACITATE	RATE OF FIRE
SINGLE ROUND	TACTICAL AIMING ERROR	$P_{HK}$	TACTICAL RATE OF FIRE
AUTOMATIC BURST	TACTICAL AIMING ERROR (FIRST ROUND) ANGULAR DISPLACEMENT (SUCCESSIVE ROUNDS)	$P_{HK}$	TACTICAL RATE OF FIRE
MULTIPLE PROJECTILE	TACTICAL AIMING ERROR PROJECTILE DISPERSION	$P_{HK}$	TACTICAL RATE OF FIRE
MACHINEGUN	TACTICAL AIMING ERROR (FIRST ROUND) OFFSET AND DISPERSION (SUCCESSIVE ROUNDS)	$P_{HK}$	TACTICAL RATE OF FIRE SUSTAINABLE RATE OF FIRE
FRAGMENTING ROUND	TACTICAL AIMING ERROR (RANGE) TACTICAL AIMING ERROR (AZIMUTH)	LETHAL AREA	TACTICAL RATE OF FIRE



## **ENVIRONMENT OF INFANTRY UNITS**

**ENVIRONMENTAL EFFECTS**

**RED CAPABILITY**

**BLUE CAPABILITY**

**MISSION STATEMENT**

**MISSION OUTCOME**



## **ADVANTAGES OF MISSION ACCOMPLISHMENT AS PRIMARY MOE**

- 1.— SINGLE MEASURE**
- 2.— REFLECTS TOTAL ENVIRONMENT OF SMALL ARMS**
- 3.— REFLECTS THE EFFECTS OF SMALL ARMS**
- 4.— EASILY UNDERSTOOD BY CIVILIAN AND MILITARY**

## **SMALL ARMS INDICATORS**

**BLUE CASUALTIES**

**RED CASUALTIES**

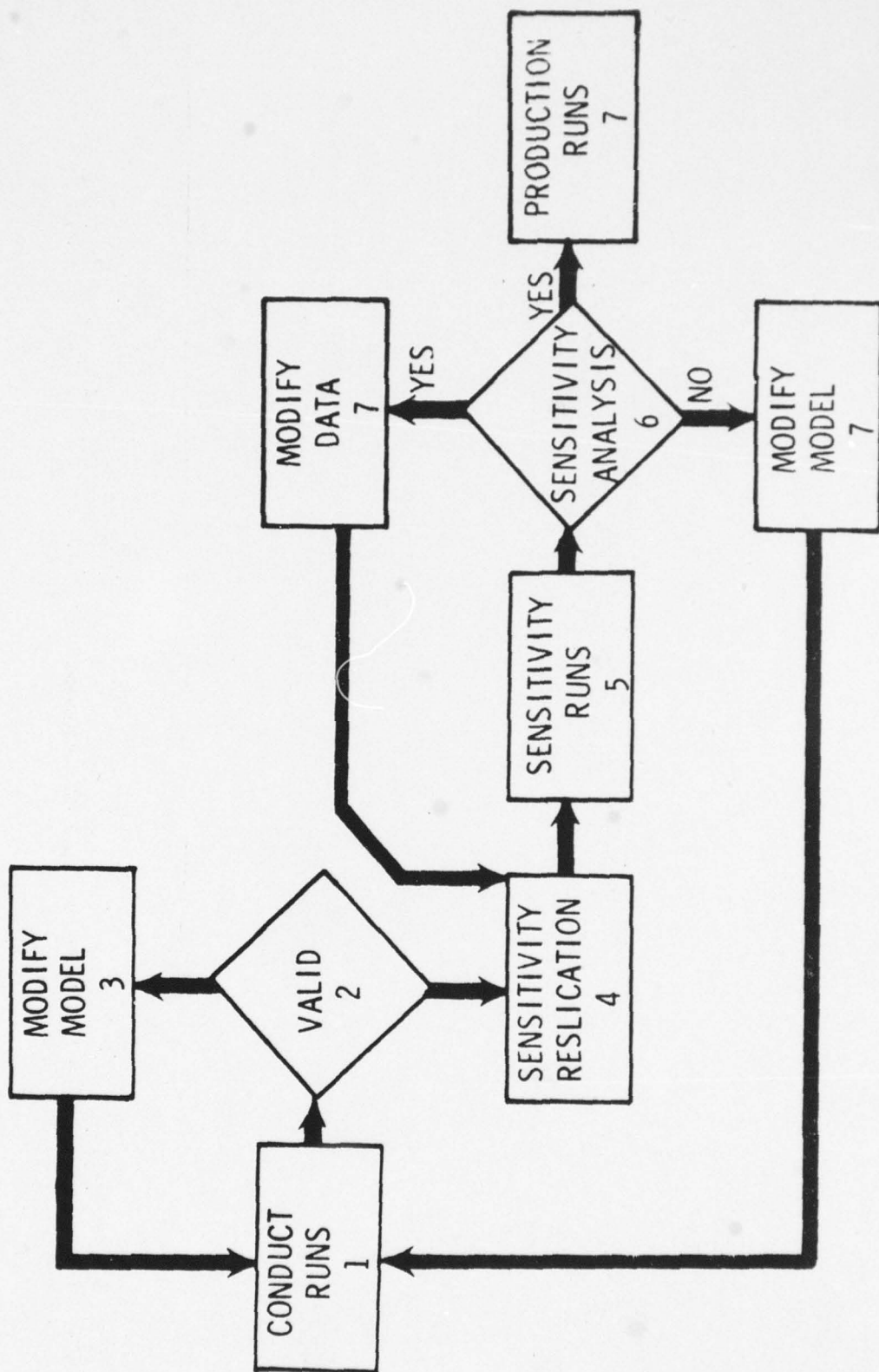
**BLUE SUPPRESSION**

**RED SUPPRESSION**

**TIME**

**DISTANCE**

PRELIMINARY EXPERIMENT STEPS



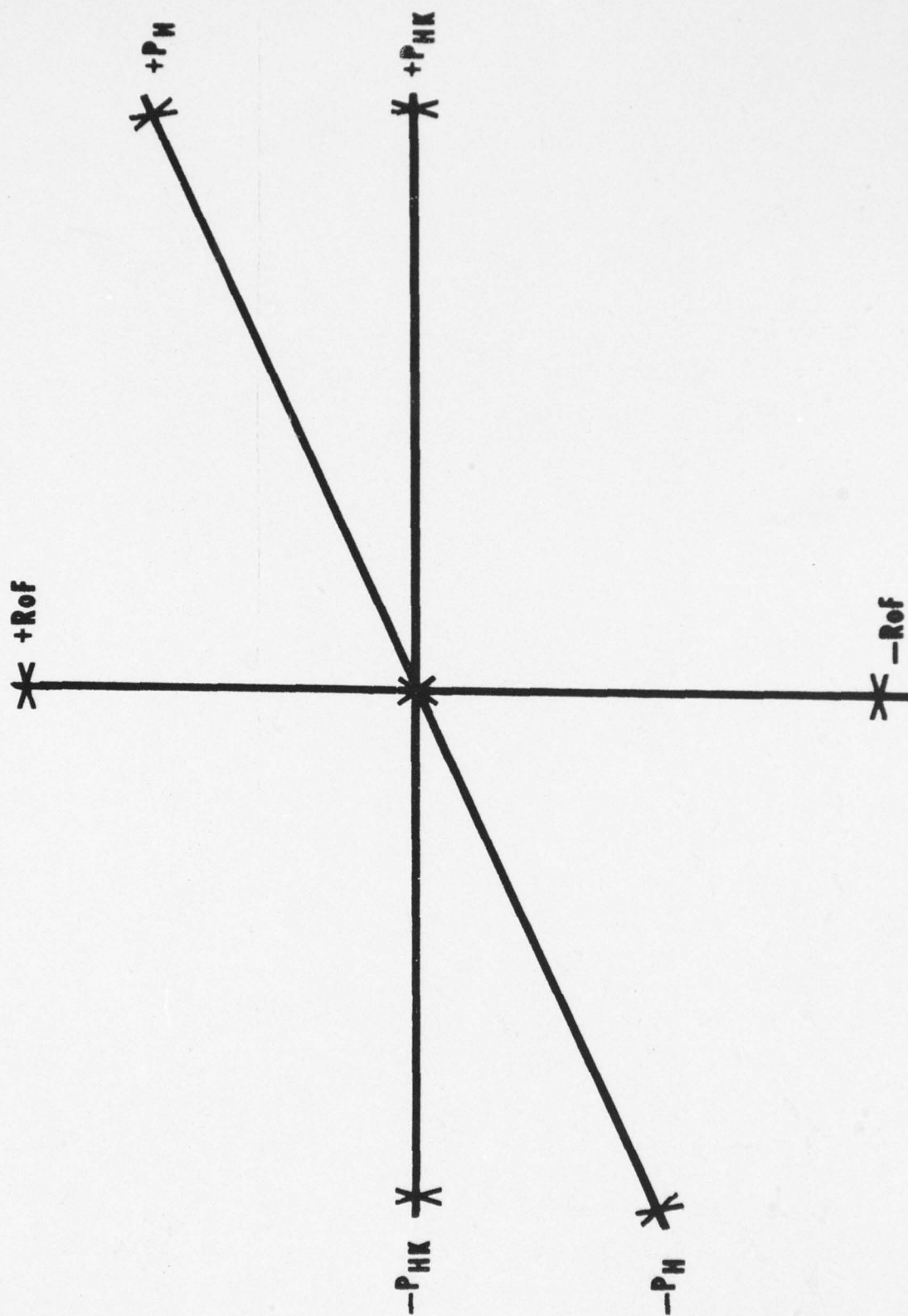


## **ASARS II TASK IV**

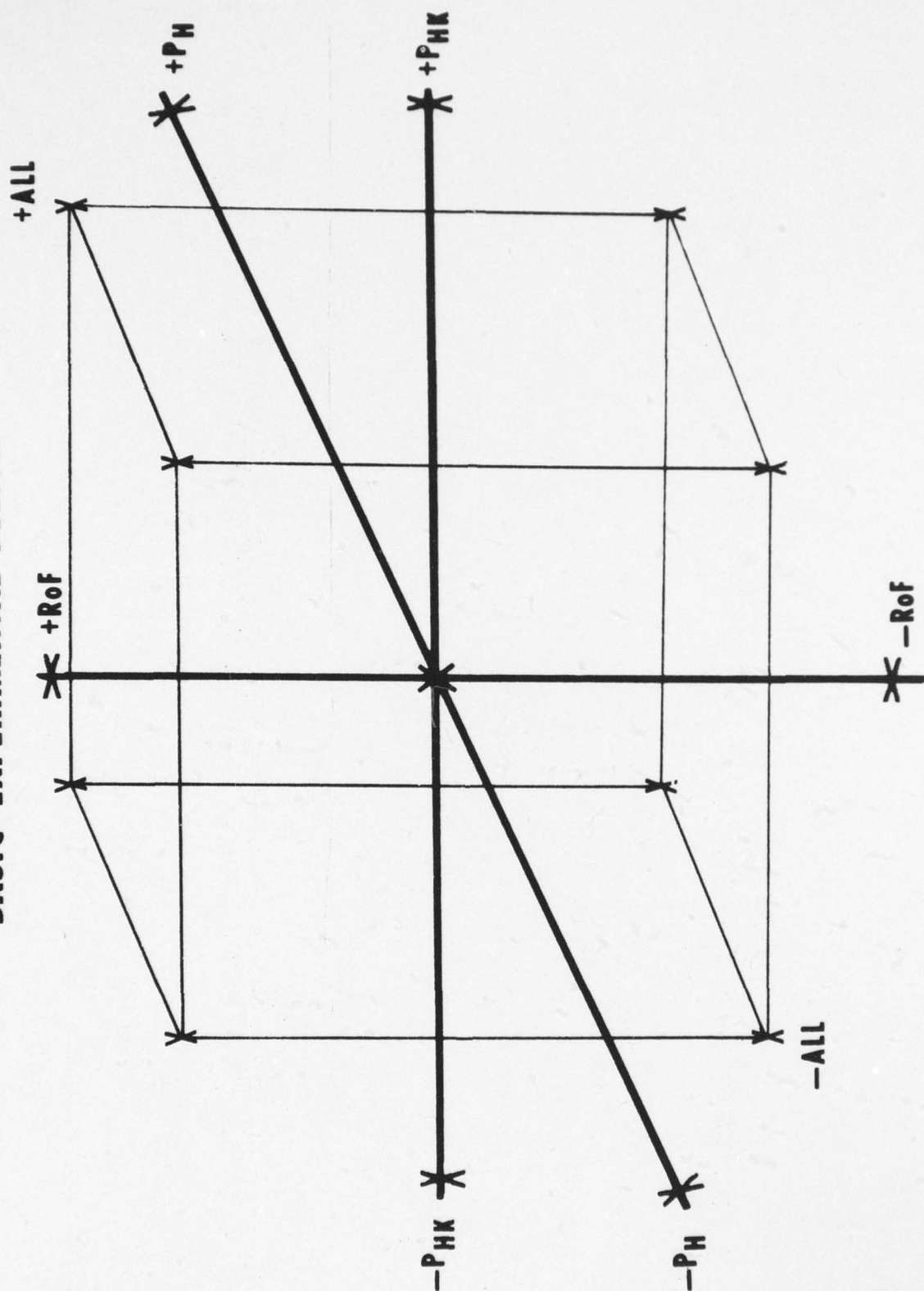


**DETERMINE THE RELATIVE CONTRIBUTION OF  
VARIOUS SMALL ARMS WEAPONS CHARACTERISTICS  
TO OVERALL COMBAT EFFECTIVENESS FOR EACH  
CONFLICT INTENSITY IN ATTACK, DEFENSE AND MEETING  
ENGAGEMENTS IN THE VARIOUS AREAS CONCERNED.**

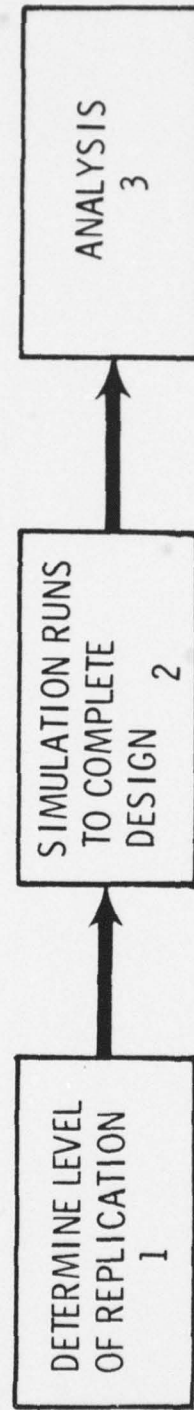
## BASIC EXPERIMENTAL DESIGN



# BASIC EXPERIMENTAL DESIGN



BASIC EXPERIMENT STEPS



POSSIBLE OUTCOMES OF BASIC EXPERIMENT

CASE 1 - STATISTICAL ANALYSIS OF RESPONSE FUNCTIONS INDICATES NO USEFUL PREDICTION POSSIBLE.

CASE 2 - STATISTICAL ANALYSIS INDICATES SECOND-ORDER RESPONSE FUNCTIONS ARE VERY GOOD PREDICTORS OF EFFECTIVENESS.

CASE 3 - STATISTICAL ANALYSIS INDICATES THAT WHILE EFFECTIVENESS IS LINKED TO CHARACTERISTICS A SECOND-ORDER PREDICTION EQUATION DOES NOT FOLLOW ANY PREDICTION.

CASE 4 - STATISTICAL ANALYSIS INDICATES SECOND-ORDER EQUATION OFFERS GOOD PREDICTION OF EFFECTIVENESS BUT CAN BE IMPROVED.

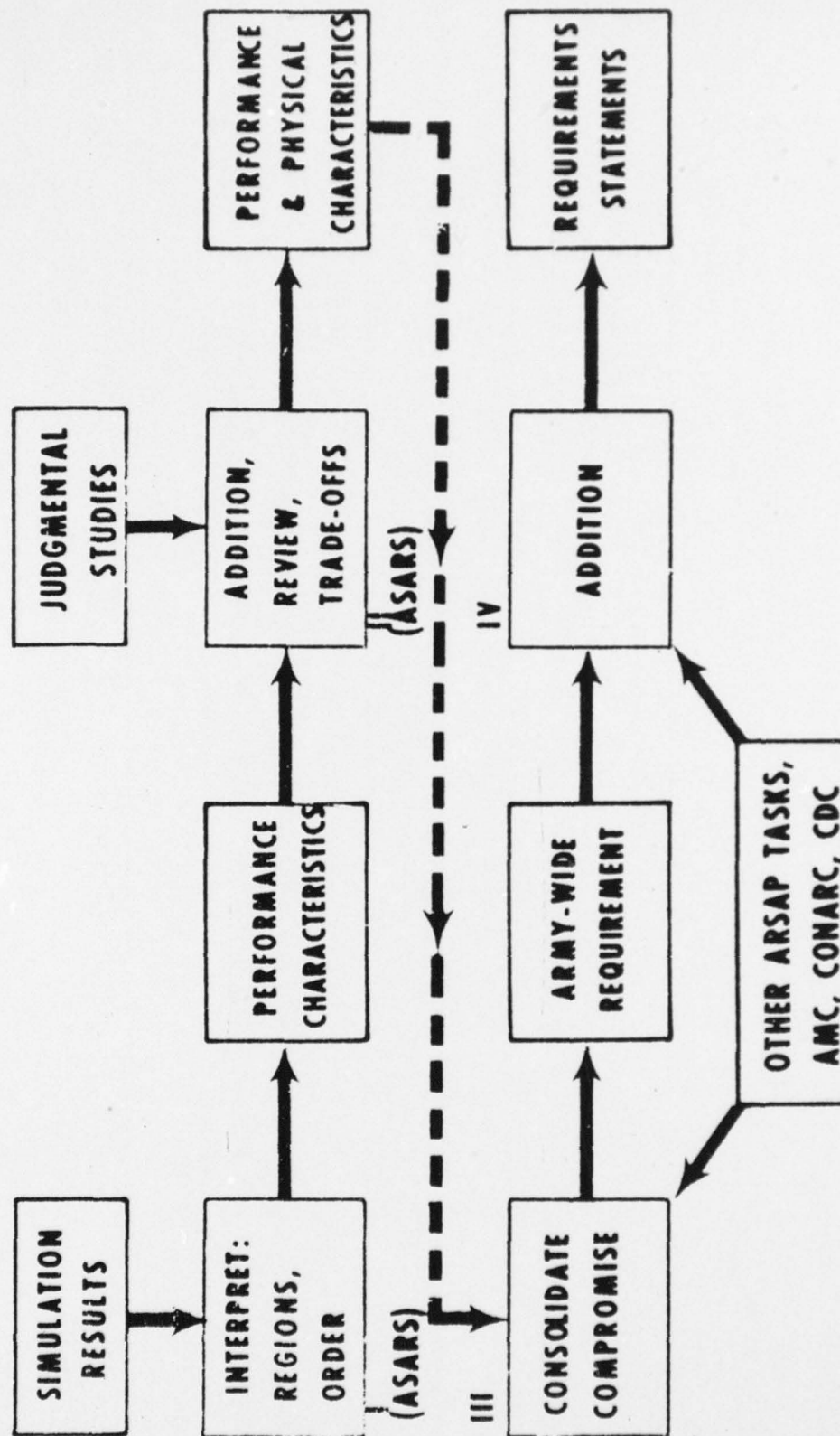


## **ASARS II**

### **TASK III**

**DETERMINE THE ROLE AND EFFECTIVENESS OF SMALL  
ARMS AS THEY RELATE TO THE INFANTRY BATTALION  
SUPPORTING WEAPONS IN COMBAT.**

# SYNTHESIS



## SCOPE OF CONTRACTOR EFFORT

1. MONITOR, COLLECT AND ANALYZE DATA FROM OTHER STUDIES, TRIALS, AND EXPERIMENTS FROM ARSAP (SUCH AS THE XM19 ENGINEERING DESIGN RETEST) AS MAY BE NECESSARY TO ACCOMPLISH THE OBJECTIVES LISTED HEREIN.
2. EXERCISE THE OPMOR I HIGH RESOLUTION INFANTRY SIMULATION MODEL. THE SCOPE OF EFFORT INVOLVED WILL INCLUDE THREE (3) TYPE INFANTRY ELEMENTS UTILIZING SEVEN (7) TYPES OF ACTION IN FOUR (4) DIFFERENT GEOGRAPHICAL ENVIRONMENTS.
3. EVALUATE, INTERPRET, TABULATE AND INDEX THE COMPUTER OUTPUTS DERIVED FROM THE PRECEDING TASK. THIS DATA WILL BE DELIVERED TO THE SPONSOR IN SUITABLE FORM WHICH WILL ENABLE THE INFANTRY AGENCY TO:
  - A. DETERMINE THE RELATIONSHIP OF SMALL ARMS TO INFANTRY BATTALION SUPPORTING WEAPONS IN COMBAT.
  - B. DETERMINE THE RELATIVE CONTRIBUTION OF VARIOUS SMALL ARMS WEAPONS CHARACTERISTICS TO OVERALL COMBAT EFFECTIVENESS FOR EACH CONFLICT INTENSITY IN ATTACK, DEFENSE AND MEETING ENGAGEMENTS IN THE VARIOUS AREAS CONCERNED.
  - C. DETERMINE THOSE WEAPONS CHARACTERISTICS WHICH ARE NEEDED TO SATISFY THE SMALL ARMS REQUIREMENTS IN ARMY-85 AND THE TRADE-OFFS FOR EACH WEAPON SYSTEM CHARACTERISTIC IN TERMS OF COMBAT EFFECTIVENESS.

MANPOWER REQUIREMENTS - ASARS II  
(MAN MONTHS PER QUARTER)

FY 71

QTR 1	QTR 2	QTR 3	QTR 4
PROJECT MANAGEMENT			
3	3	3	3
MONITOR AND ANALYZE OTHER STUDIES & TESTS			
6	6	6	6
SCENARIO & TERRAIN PREP & CODING		SIMULATION RUNS	
3	6	6	6
ANALYZE, DEVELOP & CODE WPN CHAR		ANAL SENSI- TIVITY TESTS	SYNTHESIS PLANNING & CONDUCT
6	6	3	3
		REGRESSION PLANNING & ANALYSIS	
		6	

TECHNICAL ASSISTANCE (KEY PUNCH, TRANSCRIPTION, ETC.)

3	3
<u>6</u>	<u>3</u>
21	27
TOTALS	

FY 71 - 96 M/M

MANPOWER REQUIREMENTS - ASARS II  
(MAN MONTHS PER QUARTER)

FY 72

QTR 1	QTR 2	QTR 3	QTR 4
3	3	3	3
PROJECT MANAGEMENT			
6	6	6	6
MONITOR AND ANALYZE OTHER STUDIES & TESTS			
SIMULATION RUNS			
6	6	3	3
PLANNING & CONDUCT SYNTHESIS		COMP SYNTHESIS & PREP FINAL RPT	
3	3	6	6
REGRESSION PLANNING & ANALYSIS			
6	6		

TECHNICAL ASSISTANCE (KEY PUNCH, TRANSCRIPTION, ETC.)

3	9	9
	6	
TOTALS	27	27

FY 72 - III M/M

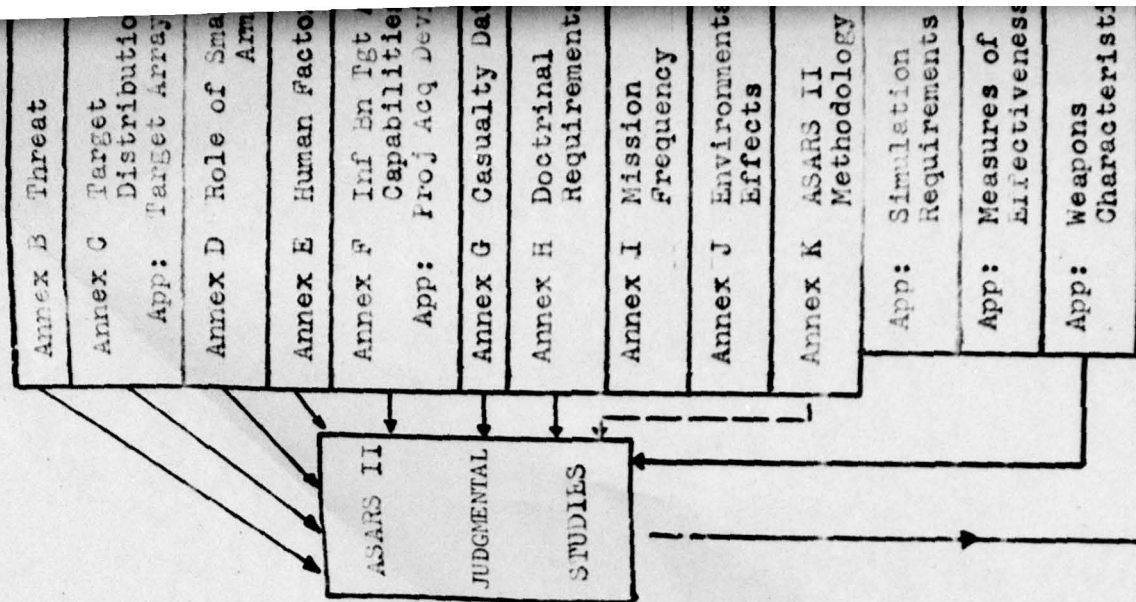
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# ASARS I



INPUT TO MATERIEL REQUIREMENTS DOCUMENTS

\* STATEMENT OF REQUIREMENT

OPERATIONAL CONCEPTS

ORGANIZATIONAL AND LOGISTICAL CONCEPTS

TENTATIVE BASIS OF ISSUE

TROOP TESTING

\* REASON FOR REQUIREMENT

TECHNICAL FEASIBILITY

PRIORITY

\* PERFORMANCE CHARACTERISTICS

\*Range

\*Accuracy

\*Lethality

\*Type of Fire (Mode)

\*Rate of Fire

\*Use Rate

\*Penetration

\* PHYSICAL CHARACTERISTICS

\*Weight (Ammo)

\*Size (Thru Concept)

Shape

Caliber

Sight

Durability

Associated Equipment

MAINTENANCE CHARACTERISTICS

HUMAN ENGINEERING CHARACTERISTICS

\* PRIORITY OF CHARACTERISTICS

PERSONNEL CONSIDERATIONS

TRAINING CONSIDERATIONS

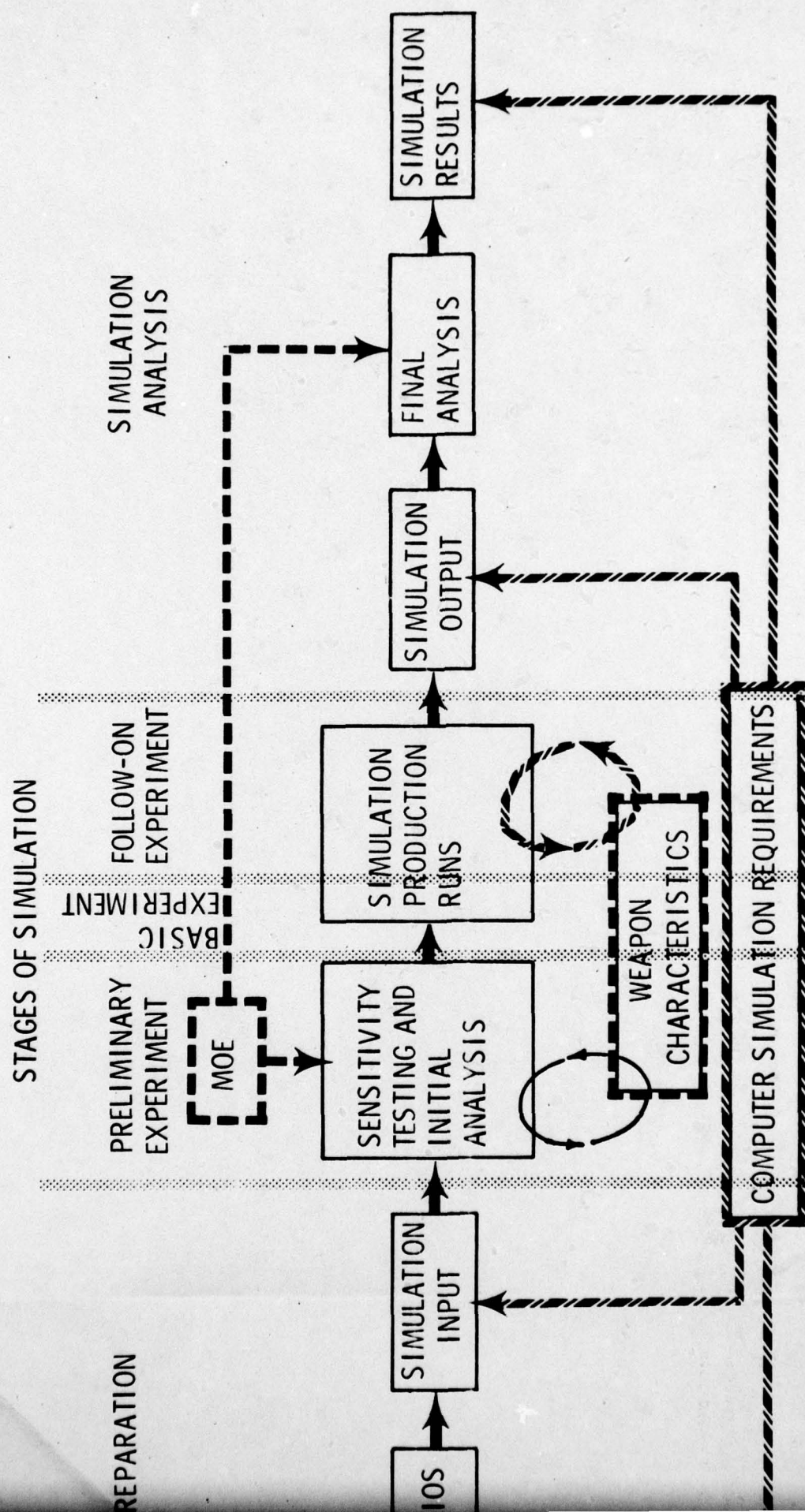
TRAINING DEVICES

RELATED MATERIEL

CONCEALMENT AND DECEPTION

PROBABLE INTEREST OTHER ARMIES

EXISTING OR DEVELOPMENTAL ITEMS



PREF

ASARS  
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SCENARIOS



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